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IMPRESSIONS OF THE EAST MALLING RESEARCH STATION[1]

R. C. PALMER[2]

Dominion Experimental Station, Summerland, B.C.

The East Malling Station is considered by many to be the foremost horticultural research institution in the world. Established in 1912, with a Director and one other man comprising the entire staff, it has developed with remarkable rapidity until today there is a technical personnel of twenty-five, an administrative staff of eight, and a full time labouring force of over forty. There are 120 acres of land under very intensive cultivation. Modern laboratory buildings have been constructed and equipped with the precise apparatus essential for accurate scientific investigations. Most important of all, an atmosphere of enthusiasm and a spirit of service pervade the whole place. This is true not only of the internal organization of the Station, but also of its relations with other research institutions. The most cordial and harmonious relations are maintained with the Imperial College of Science and Technology, the John Innes Horticultural Institution, the Wye Agricultural College, and the Horticultural Research Station at Long Ashton.

The East Malling Station was originally established to solve practical problems encountered in the orchards and berry plantations of Kent. The active support received from practical growers throughout the County is ample proof that this function is being abundantly fulfilled. Nevertheless, much of the work of the Station is of a fundamental nature leading to discoveries of value to fruit growers the world over. In fact, one of the outstanding features of the organization of this Station is the harmony with which "applied" and "pure" science investigators work side by side under the same roof.

The foundation of East Malling's successful attack on horticultural problems seems to be an intimate knowledge of plant materials. From the first, it was fully realized that uniform plant material is a primary requirement for the application of scientific methods to horticulture. To this end much time and care were devoted to isolating varieties of berries true to name. This apparently simple and obvious procedure of isolating pure strains of berries brought an unexpected reward in that it revealed amazing variety partialities for different environmental conditions. Furthermore, it resulted in discovery of the fact that virus diseases are causing serious losses in the black current and raspberry plantations of England. This discovery paved the way for further investigations by Plant Pathologists and Entomologists, who were forthwith added to the staff of the Station.

[1]A paper prepared for the Horticultural Group of the C.S.T.A., meeting at the World's Grain Exhibition and Conference, Regina, Sask., July 27, 1933.

[2]Superintendent.

The problem of securing uniform experimental material of the tree fruits proved even more difficult of solution, for few tree fruits can be readily propagated on their own roots with the result that the general practice has been to bud or graft the fruiting varieties on seedling root stocks. Lack of uniformity in these seedling stocks introduced a variable which the East Malling investigators set themselves to eliminate. After twenty years of concentrated effort they are presenting to the world clonal root stocks for practically all the deciduous fruits. In most cases these vegetatively propagated stocks are comparatively easy to raise, with the result that they promise to find their way rapidly into commercial orchards. It is in the orchards of research stations, however, that clonal stocks are of supreme importance for they make possible an experimental technique combining accuracy with the use of comparatively small units of plant material.

The emphasis placed on uniformity of plant material at the East Malling Station naturally resulted in the development of a Propagation section. This section conducts investigations into the most economical methods of producing uniform plant material. It is also charged with the task of providing suitable experimental material for the use of all other sections on the Station. Furthermore, it now furnishes large quantities of material to commercial nurserymen and to experimental institutions throughout the world. In fact, the excellent reputation of the East Malling Station is due in large measure to the success which has attended the efforts of the Propagators to produce uniform plant materials of a superior grade.

The performance of trees propagated on clonal root stocks has proved beyond question that the behaviour of fruit trees is influenced by the root stocks on which they are worked. There still remains the problem of the fundamental cause of these stock effects. It seemed probable that the primary source of stock influence might be found in the spheres of Plant Physiology or Bio-chemistry. Accordingly, the services of Physiologists and Biochemists were enlisted in the hope that they might be able to ascertain the principles underlying the phenomena observed by the Pomologists. That this hope is justified has already been demonstrated by a valuable contribution of Physiology to the problem of "speeding up" vegetative propagation of root stocks. It has been discovered that when the base of a stem is protected from exposure to light from its early stages of growth, rooting takes place comparatively freely from this "etiolated" portion of the stem. Discovery of this general principle has facilitated the propagation of a wide range of stocks which had previously proved almost impossible to raise by vegetative means.

Although East Malling is primarily a research rather than an advisory institution, the tendency of growers to go to the original source for information has necessitated the formation of an extension section. This section organizes all educational activities, but one of its chief duties is to protect the research men from too much disturbance in the way of correspondence and advisory visits. A "guide demonstrator" relieves the technical investigators from the duty of repeatedly explaining the purpose, methods and results of their work to the constantly increasing number of interested people who visit the Station.

Finally, a statistical section has been developed to assist in the planning of experiments and in the interpretation of the results secured. This section has already proved its worth and there are evidences that it will play a major rôle in development of the "science" as contrasted with the "art" of horticulture.

Thus, various specialists have been taken on the staff of the Station as the complex nature of the problems under investigation has become apparent. It is the practical service already rendered by the Station, however, which has made it possible to secure the funds necessary to conduct the fundamental researches which are now in progress.

The Station is financed mainly by the British Ministry of Agriculture and the Empire Marketing Board, but some funds are contributed by various County Councils and industrial concerns. There is also a membership scheme through which growers contribute directly to the upkeep of the Station. Sale of produce is an additional source of funds. Furthermore, there is the nucleus of an endowment fund designed to provide an independent source of revenue which can be drawn upon in times of emergency.

The affairs of the Station are ultimately supervised by a "Committee of Management" made up of representatives of the Ministry of Agriculture, County Councils, research institutions, the National Farmers' Union, the Horticultural Trades Association, and the Institute of Brewing, an even balance being maintained between the number of "scientific" and "practical" members. An Executive Committee drawn from the above assists in deciding matters of policy, finance, etc., but most of the responsibility for operation of the Station falls on the Director and on the Chairman of the Executive Committee who pays almost weekly visits to the Station to discuss problems of management.

Although the activities of the Station are restricted almost entirely to study of fruit problems, the staff is organized in sections dealing with Pomology, Physiology, Pathology, Entomology, Bio-chemistry, Propagation, Statistics, Extension and Administration. In addition, the Imperial Bureau of Fruit Production comes under the supervision of the Director of the East Malling Station.

Pomology is by far the largest section. It is headed by the Director who is primarily a Pomologist, although he is a man of such keen insight and wide sympathies that investigators from all sections instinctively come to him for guidance. The Farm Manager also belongs to this section. He occupies a "key" position in the organization of the Station in that he is the intermediary between the technical investigators and the labouring force. It is his business to ensure that research work takes precedence over general farm operations when there are conflicting demands for labour. At the same time he is responsible for economical management of the farm. This dual duty necessitates a thorough knowledge of both "scientific" and "practical" horticulture—a combination seldom found in one man. In fact, the Farm Manager's responsibilities are second only to those of the Director. He has supervision over all cultural operations which leaves the technical investigators free to concentrate on their special problems.

The "Assessor of Market Qualities" is another important member of the Pomology section. He supervises all picking and packing operations

and also attends to the actual sale of the produce. He is charged with the double duty of selling the produce at a remunerative price and at the same time securing accurate data on the influence of cultural, harvesting and packing procedure on the returns secured.

The special investigators studying pruning, thinning, root growth, plant nutrition and plant breeding also belong to the Pomology section. So, too, do the Recorders, who are largely responsible for the accurate and comprehensive records on which the good reputation of the Station has been built.

The regular schedule of operation includes a weekly "Recorders' Meeting" of which the Farm Manager is Chairman and the senior Statistician is Secretary. This meeting, usually attended by the Director and the entire Pomology staff, provides a "clearing house" for information. It is held ostensibly to formulate the Pomology programme for the following week, but almost any subject may come up for discussion and any member of any section may attend and ask for special assistance. The presence of the Statistician ensures that all necessary records will be taken during the coming week and the presence of the Farm Manager ensures co-ordination of research and general cultural activities.

The year's programme of each section is discussed and formulated during the winter months, first within the section or sections concerned, and finally at a general meeting of the entire staff. To further ensure that the members of each section are familiar with the investigations which are being conducted by their colleagues in the other sections, general staff meetings are held twice a month during the winter. At these meetings papers are presented outlining the methods of procedure and the progress made towards solution of the various problems under investigation. Discussion is invited and exchange of views is often quite animated. Friendly intercourse between the members of the various sections is also encouraged at meal times when all meet under the harmonising influence of food and liquid refreshment. The desire to be mutually helpful is so strong that investigators seem glad of the opportunity to lend equipment to each other!

The regular working hours of the technical staff are from 9 to 5 with 1 hour off for lunch, and 15 minutes off for afternoon tea. There is no checking in or out, but the tendency is to work overtime rather than to take undue advantage of the freedom allowed. In fact, some of the most valuable discoveries made by the Entomological staff are the result of staying up all night with a flash light observing the nocturnal habits of insects. Such enthusiasm is doubtless the fruit of a farsighted policy which aims to give every member of the staff a keen interest in his work and in the general welfare of the Station. Even the youngest laboratory assistant is encouraged to carry out some special project which is his very own responsibility. The Director, Mr. R. G. Hatton, makes it plain that he is at the service of each and every member of his staff. In return, he receives their wholehearted support. In fact, one cannot escape the conclusion that the East Malling Research Station is the product of one man's vision, enthusiasm and personality. In a truly miraculous manner, the Director, by the strength of his own character, has welded many diverse and conflicting elements into a unified, efficient and remarkably contented staff.

STUDIES IN PLANT NUTRITION

A Report of Experiments in Progress at the Long Ashton Research Station

R. C. Palmer[1]

Dominion Experimental Station, Summerland, B.C.

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Long Ashton is justly famous for achievements in the field of plant nutrition. These achievements have been made possible by the fact that pomologists and chemists have worked side by side in their efforts to solve practical problems encountered by the grower.

In briefest outline the procedure has been:

1. Grow plants in clean sand which permits accurate control of the nutrient supply.
2. Record the influence of modification of the nutrient supply on the behaviour of the plants.
3. Use the knowledge so gained for the diagnosis of symptoms observed in the plantation.
4. Check the accuracy of the diagnosis by field trials.

The most striking success of this procedure has been in connection with the condition known as "Leaf Scorch". A few years ago this condition, characterized by a scorched appearance of the leaves, weak growth and low yields, was prevalent in many English orchards and berry plantations. Pathologists had failed in their efforts to ascertain the cause of "Leaf Scorch", and fertilizer trials on a field scale had given inconclusive results. Pot experiments carried out at Long Ashton, soon showed that plants grown under conditions of potash deficiency developed symptoms similar to those exhibited by plants suffering from "Leaf Scorch". Subsequent field trials have proved that in most cases, "Leaf Scorch" can be overcome by heavy applications of sulphate of potash, although three or more years usually elapse before the full benefits of the fertilizer are realized. The general recommendation at present is to apply sulphate of potash annually at the rate of 500 pounds per acre, the material being broadcast on the surface of the soil in the autumn. Growers are being cautioned against the use of forms of potash containing chlorine, as these have been found to cause serious injury to some crops, especially gooseberries.

In view of the striking benefits which have followed the application of potash to English fruit plantations, it is remarkable that so many American investigators have reported negative results from the use of potash in orchard fertilizer experiments carried out in the United States. In this connection it is noteworthy that the most obstinate cases of "Leaf Scorch" have occurred on shallow soils underlaid with hard pan or where there is a high water-table. It is under somewhat similar conditions that such troubles as "Cork" and "Drought Spot" are most prevalent in the Okanagan Valley.

[1] Superintendent.

The Long Ashton controlled nutrient experiments have also provided valuable indications as to the manner in which deficiencies of nitrogen, phosphorus, calcium and magnesium are likely to reveal themselves in plant behaviour. The symptoms of nitrogen starvation are, of course, well known to many Canadian orchardists. Even under English conditions there is ample evidence that it is often advisable to apply nitrogen to fruit plantations. English orchards also provide plenty of proof, however, that the application of unduly large amounts of nitrogenous fertilizers may produce disastrous results. Thus injuries due to potash deficiency are greatly intensified by the application of nitrogen.

Potted trees fed on a nutrient solution deficient in phosphorus have exhibited very marked evidence of phosphorus starvation. It appears significant, however, that these symptoms have not yet been observed in the orchard, even on trees growing in locations where the soil is extremely low in phosphorus. Apparently fruit trees are especially well equipped for securing their phosphorus requirements from the soil.

The Long Ashton experiments indicate that the ratio of potash to nitrogen in the nutrient supply not only influences the growth and productivity of apple trees but also materially affects the quality of the fruits produced. In studying this phase of the problem fruit from trees growing under various nutritional conditions has been kept in storage. It has been found that Bramley apples grown under conditions of low potash supply have a very long life at common storage temperatures and a very short life when kept at a temperature of 32° F. owing to increased susceptibility to low temperature breakdown.

The storage programme includes a study of the influence of such factors as root stock, bark ringing, pruning, thinning, fertilizer treatment, time of picking, etc., on the keeping quality of fruit. Chemical analyses are made in an attempt to ascertain the extent to which storage behaviour is correlated with chemical composition. Extremely interesting results have been secured which indicate the complexity of the problem and the dangers of attempting to generalize from less comprehensive experiments. The evidence secured suggests that while keeping quality is undoubtedly correlated with chemical composition, especially as regards the amount of nitrogen and sucrose present in the fruit, the relation is by no means a simple one. In fact apples of apparently similar nitrogen and sucrose content produced by "grass culture" and "bark ringing" respectively have behaved very differently in storage. It is believed that the form in which the nitrogen is present may be the key to keeping quality and special methods of analysis are being developed to test this theory.

One interesting point brought out by these storage investigations is that an apple developed from the central flower of a cluster has a very different chemical composition from an apple produced by a lateral blossom. Strangely enough this appears to hold true though only one apple is permitted to develop from each of a number of flower clusters. Since the apples produced by lateral flowers have been found to be sweeter, firmer and more resistant to rots, it is suggested that it may be worth while to remove the central fruits during the operation of thinning.

Intensive soil and pomological surveys form an important feature of the plant nutritional investigations at Long Ashton, the aim being to ascertain the extent to which soil characteristics are reflected in plant performance. In these surveys, a chemist and a pomologist collaborate, the chemist classifying the soils according to physical and chemical characteristics, drainage conditions, etc., and the pomologist securing a detailed record of plant behaviour. Emphasis is placed on the importance of giving the chemist and pomologist equal authority and making each of them responsible for his part of the programme. They are encouraged to consult each other frequently, but it is considered advisable that they make their field observations separately, it being thought that too close association might lead them to see correlations where in fact none existed.

In practice it has sometimes proved very difficult to distinguish between the effects of adverse soil conditions and the effects of poor management. Nevertheless, the surveys have revealed that there is commonly a very close correlation between soil characteristics and plant growth. It has been found that certain fruits and even certain varieties have very definite soil preferences. This information should prove invaluable as a guide to future planting. The data secured also provide a basis for decisions as to whether, in existing plantations giving poor performance, it is worth while to apply remedial measures or wiser to devote the land in question to more adaptable crops.

Combined pomological-chemical attack of fruit problems as exemplified by the Long Ashton work offers great promise as a means of ascertaining the fundamental cause of so-called physiological diseases. Close association of chemists and pomologists ensures that the chemist acquires some of the sympathetic insight of the pomologist and conversely the pomologist develops a very real appreciation of the value of the precise methods employed by the chemist. This method of attack has already been used to good advantage at the Summerland Station in the study of Red Strains of the Delicious apple. Investigations of this type are of great practical as well as scientific importance and it is most desirable that they be continued and extended even in the face of reduced appropriations.

EGGPLANT WILT[1]

J. K. Richardson[2]
Dominion Laboratory of Plant Pathology, St. Catharines, Ontario.

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The prevalence of Verticillium wilt of eggplant (*Solanum melongena* Linn.), (Figure 1), in Southern Ontario has increased to such an extent that many vegetable growers have discontinued the culture of this plant. Even those who are still fortunate enough to be able to grow this crop with a reasonable assurance of some emolument for their expended labours, are seldom, if ever, free from this trouble.

Wilt of eggplants was reported in 1913 by Wollenweber (*21*) as being caused by the fungus *Verticillium albo-atrum* R. & B. Orton (*16*), Haenseler (*8*), Guba (*6*), and Jagger and Stewart (*14*) have reported the trouble from various localities in the United States. Howitt (*12*) reported the disease in Ontario in 1919, but it has no doubt been present in this locality for a much longer period than this notation would indicate because Verticillium wilts on other hosts were reported much earlier.

The fungus which causes the wilt of eggplants is not specific to that host but has been shown to be capable of producing a similar disease in other plants, namely, okra (*3*), udo (*19*), barberry and maple (*14*) and cotton and Antirrhinum (*15*). Rudolph (*21*) records some 125 hosts that have been reported as having been infected by species similar, or very closely related to the Verticillium causing eggplant wilt.

All varieties of eggplants used in connection with the present studies, namely, New York Purple, Black Beauty, Black Nagasakia, Early Dwarf and Blackie exhibit little or no resistance to the disease. Haenseler (*9*, *10*) reports that the Italian varieties are slightly more resistant than the native ones but not immune, and Chupp (*4*) mentions that Florida Highbush appears resistant in Niagara County, New York. Guba (*6*) states that a large number of varieties were tested but none showed resistance to the wilt. Jagger and Stewart (*14*) tested twenty-eight varieties from the United States, France, England and China and all succumbed to the disease.

Symptoms

Eggplant wilt can be readily recognized. Diseased plants have a stunted appearance with wilted, chlorotic and dead foliage, varying in amount with the severity of infection. The first indication of the disease is the appearance of flaccid or slightly chlorotic areas on the basal leaves of the plant. In a short time these areas turn yellow and become necrotic (Figure 2), and the entire leaf soon withers and falls from the plant. The disease progresses upwards and causes severe stunting or death of the plant. The entire plant usually exhibits the disease, but cases have been observed where only one side of the plant shows the symptoms, as is often the case with perennial hosts infected by the wilt organism. Dissection of diseased plants reveals a browning of the vascular tissues varying in intensity with the severity of the infection. The fruits, besides showing a reduction in size and number

[1] Contribution from the Division of Botany, Experimental Farms Branch, Department of Agriculture, Ottawa, Ontario.
[2] Assistant Plant Pathologist.

which would ordinarily be expected from a stunted parent, occasionally become deformed or curved.

Infected plants which are growing slowly often exhibit less severe leaf symptoms in the form of small, numerous wilted areas which seldom coalesce to involve the entire leaf. On the other hand, succulent, rapidly-growing plants show the severe leaf wilting. All gradations in the severity of symptoms between these two extremes may appear in a single plant throughout its growing period under changing environmental conditions.

A plant which is infected by the pathogen early in its growing period is usually doomed, for if it is not entirely killed it becomes so dwarfed that it never produces fruit. However, if the infection does not occur until later in the season the vigour of the plant will often retard the progress of the disease sufficiently to enable it to produce some crop. It is not uncommon to see plants in the field which have outgrown the disease to a considerable extent due to favourable growing conditions following a period of slow development. Unless this takes place early in the growing season, however, it is of little value because the new growth is unable to mature fruit.

On a few plants in the greenhouse, irregularly shaped necrotic areas without marginal chlorosis have appeared on the leaf blades. Although this condition is not general, in cases where it has been observed the leaf became wilted at a later date.

Etiology

There is a difference of opinion in the interpretation of the original description of *V. albo-atrum* R. & B. Some workers claim that it includes the species *V. Dahliae* Kleb. while others maintain that *V. Dahliae* Kleb. is a distinct form and entitled to specific rank. Van der Meer (*18*), Dufrenoy and Dufrenoy (*5*), Berkeley, Madden and Willison (*1*), and others, state that *V. Dahliae* produces definite pseudosclerotia in culture while *V. albo-atrum* does not. In view of the fact that all of the isolations made from diseased eggplants during the present investigation produced definite pseudosclerotia in culture, the pathogen is being tentatively identified as *Verticillium Dahliae* Kleb.

The pathogenicity of the fungus was established in the usual manner by isolation, culture, inoculation, re-isolation and comparison. The organism is an extremely virulent parasite, being able to produce disease symptoms ten days after a stem incision inoculation and two weeks after the addition of a spore suspension to the soil. The average incubation period, however, is between three and five weeks.

The various species of Verticillium are primarily vascular parasites (Plate II, Figures 13 and 14). The fungus gains entrance to the plant through the roots, becomes established in the vascular tissue, and through this, passes to all parts of the plant. Infected vascular tissue shows a discoloration which may vary in colour from amber to almost black (Plate I, Figures 3 to 6), but frequently severely diseased plants will show the browning only in localized areas. Extreme discoloration of the vascular tissues has been observed in diseased plants in the roots, main stem and branches, leaf petioles and veins, fruit pedicels and fruit in all stages of maturity. Similar conditions have been previously reported by Jagger and Stewart (*14*).

The eggplant wilt organism is capable of living in the soil for a considerable time, thus providing inoculum for the infection of susceptible hosts.

Cultural Investigations

Cultural characters.—On the surface of artificial media the fungus forms a soft, loose, white cottony mass of hyphae (Plate II, Figure 8) producing verticillate conidiophores which bear spherical to ovate conidia in profusion (Plate II, Figure 11). The typical congregation of spores in droplets of moisture is visible in Plate II, Figure 12. There are formed within the medium a large number of thick-walled, short, dark, multiple-celled bodies or pseudosclerotia which give the culture a dark appearance (Plate II, Figure 15). The quantity of these black bodies varies considerably, but they have been observed in all isolations.

Temperature and acid relations.—Although the optimum temperature for the growth of the pathogen on potato dextrose agar is between 21°C and 24°C, it will grow at temperature as high as 34°C and as low as 8°C. At 28°C to 30°C growth is considerably retarded and produces a heavy white tuft of mycelium with few pseudosclerotia. Above 31°C it is extremely slow, the colony has a definite compact cerebroid formation and no pseudosclerotia are produced. At 34°C the first visible growth appears after an incubation period of three weeks. At temperatures below the optimum the colony is normal in appearance but the growth is greatly reduced.

The organism's response to variations in the reaction of potato dextrose decoction adjusted with hydrochloric acid and sodium hydroxide solutions shows approximately equal growth within the range of pH 9 to pH 5.4. At pH 4.5 growth is essentially similar but there is less pseudosclerotial development, and between pH 3.9 and pH 2.3 only meagre growth immediately surrounding the original inoculum. These pH tolerances coincide with those recorded by Haenseler (*11*).

Fungus isolations.—In 1918 Jagger and Stewart (*14*) isolated a species of Verticillium from the fibro-vascular bundles of all parts of wilted eggplants including the fruit. Haenseler (*7*) and (*8*), stated that the fungus hyphae were noted in the secondary roots, primary roots, main stem and secondary branches to within a few inches of the growing tip but no hyphae were found in the pedicel of the fruit, and tests proved that the wilt disease was not transmitted through the seed either externally or internally.

During the course of the present investigations, isolations from a large number of plantings of the vascular tissues from all parts of diseased plants proved conclusively that the pathogen can be isolated from all parts of the host including the seed (Plate II, Figure 9). Positive isolations are most frequently obtained from tissues which show intense vascular browning.

The following technique was always used when making isolations from host tissues. The part of the plant to be used was thoroughly washed and sterilized in mercuric chloride. A portion of the host tissue was removed aseptically and planted on a potato dextrose 2.5% agar slope which had previously been acidified with two drops of a 25% lactic acid solution, and the cultures incubated at room temperature.

In connection with the presence of the pathogen within the fruit, one series of isolations will be of interest here. From a field experiment, the

Figure 1. Eggplants growing together in the same field; the one on the left is typically diseased, while the other is healthy.

Figure 2. Leaves from diseased eggplants showing two progressive stages in the wilting of the tissues.

PLATE I.

Figures 1 and 2. The appearance of the fruit from healthy plants in longitudinal and cross sections.

Figures 3, 4 and 5. The typical browning of the vascular tissues in the fruit of wilt infected plants.

Figures 6 and 7. Severe vascular browning in the stem of a diseased plant and the absence of abnormal discoloration in a healthy specimen respectively. The dark lines in the healthy specimen are due to the presence of dark green parenchymatous tissue inside the vascular ring.

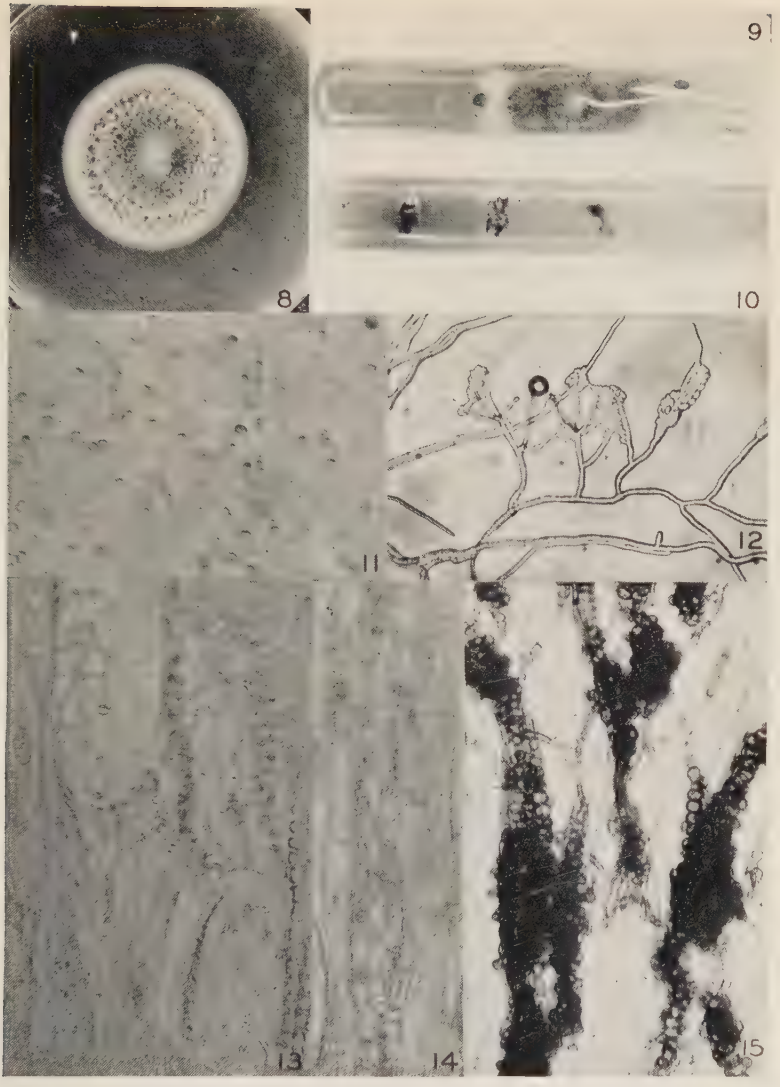

PLATE II.

Figure 8. Ten day old colony of *Verticillium Dahliae* Kleb., on potato dextrose 2.5 per cent agar incubated at 20°C.

Figure 9. The pathogenic fungus growing from an eggplant seed which has also germinated. The seeds were removed aseptically from a fruit which showed severe vascular browning and planted on a potato dextrose agar slope.

Figure 10. Plantings of tissue from diseased fruits showing the growth of the fungus from the broken ends of the vascular strands.

Figure 11. Spores of *V. Dahliae* X 350.

Figure 12. Typical aerial growth of the fungus showing the verticilliate branching of, and profuse spore development from, the conidiophores.

Figures 13 and 14. Longitudinal sections of the vascular tissue from the stem of a wilted eggplant showing the mycelium and spores within the vessels of the host.

Figure 15. The black pseudosclerotial bodies which are produced in artificial medium, and give the cultures their dark appearance.

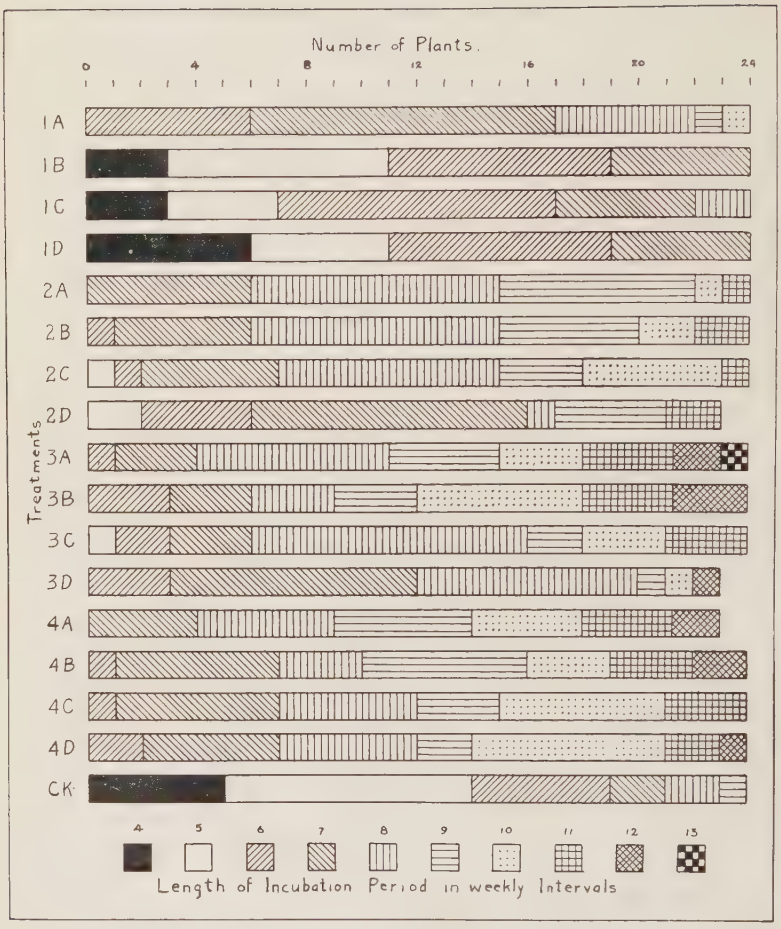

Figure 3. Graph showing the retarding effect of applications of mercuric chloride upon the development of Verticillium wilt in the field.

fruits from 38 out of 350 wilted plants showed vascular discoloration. Eighty-four per cent of these gave positive isolations of Verticillium (Plate II, Figure 10). In addition to the above, isolations from twenty-five fruits which showed no vascular discoloration gave entirely negative results. Eight of the fruits showing vascular browning were sufficiently mature to have formed seed and the plantings from these seeds returned the pathogen in six cases. This clearly demonstrates the possibility of seed transmission.

Soil Temperature Relations

Bewley (*2*) mentions that the optimum temperature for the development of Verticillium wilt of the tomato is from 70° to 73°F. (21° to 23°C.), while the minimum is 60°F. (15°C.), and the maximum 75°F. (24°C.). Guba (*6*) states that the wilt organism cannot infect eggplants at temperatures above 77°F. (25°C.), and Ludbrook (*15*) reports the temperature range for *V. Dahliae* as being 12° to 30°C.

In view of the above, experiments were conducted to determine the effect under greenhouse conditions of various soil temperatures upon the infection capability of the eggplant wilt pathogen.[3] The plants tested were grown in constant temperature water tanks, kept within the required range by either cool running water or thermostatically controlled electric heating.

TABLE 1.—INFECTION RESULTS OBTAINED BY GROWING EGGPLANTS AT DIFFERENT SOIL TEMPERATURES.

Temperature °C.		No. of plants inoculated	Incubation period in days	Per cent infection	Dates of experiment
Average	Range				
11.3	10–14	6	27	16.6	Jan 1—Feb. 19
15.2	11–19	6	18–36	50.0	Apr. 22—June 10
18.9	17–21	6	22–32	100.0	June 21—July 23
20.8	18–23	6	61–71	100.0	Apr. 1—June 10
21.6	21–23	6	62–76	33.3	Jan. 1—Mar. 15
25.0	25–26	6	18–32	100.0	June 21—July 23
30.0	30	8	16–53	100.0	Jan. 9—Feb. 28
35.0	35	6	0	0	Apr. 1—July 4

The young seedlings to be used were transplanted when about 4 inches high into sterilized soil in the metal containers in the tanks and allowed to become established for a few days before being inoculated. Temperatures were taken morning and evening throughout the duration of the tests. The tanks had accommodation for 8 plants and in all but one test, 6 of these were inoculated and the remaining 2 left as checks in order to observe the effect of the temperature upon healthy growth. Plants growing in pots in close proximity to the tanks were kept as additional checks to determine the normal host reactions to the pathogen at the time of year the experiments were being conducted.

[3] In all the infection experiments described in this paper, plants were grown from seed in steam sterilized compost, planted in sterilized pots and inoculated by the application of a spore suspension to the surface of the soil. The inoculum was obtained from monosporous cultures of the pathogen grown on oat hulls mixed with water and thoroughly rubbed through a 40-mesh sieve to remove the excess culture medium.

To maintain a temperature of 30°C. and over, it was found necessary to cover the soil containers with a layer of non-absorbent cotton about 2 inches thick, to minimize the cooling effect of the air as the greenhouse temperature during the test was from 20°C to 23°C. By this means the soil temperature anywhere in the container could be kept to within one degree of the temperature of the water in the tank.

Due to the proximity of the checks to the inoculated plants a few of the former became infected by splashing from the inoculated series during watering operations. Series were conducted at temperatures ranging from 11.3°C to 35°C.

The results of the experiment show clearly that the organism used is capable of producing wilt in eggplants growing at soil temperatures between 11.3°C and 30°C, but not at 35°C. The small percentages of infection obtained from the two lowest temperatures may be explained by the fact that within that range the plants exhibited sub-normal growth. No explanation is evident for the low percentage of disease developing at 21.6°C.

Fertilizer Effect

The fact that eggplants in the field sometimes outgrow the disease suggested that the addition of certain fertilizers to growing plants might in some way affect their reaction towards the wilt.

In this connection an experiment was set up in the greenhouse with 64 plants growing in 8-inch pots of sterilized soil. The series was divided into 8 groups of 8 plants, 7 of the groups received equal applications of fertilizer of a different formula and the eighth remained untreated as a control.

The chemical elements used were nitrate of soda, superphosphate and muriate of potash. These compounds were used singly and in the following combinations: 4-8-4, 4-4-8, 4-8-8 and 4-4-12. The fertilizers were added to the soil at weekly intervals and in such quantities that an equal amount of available food material was applied to each plant. The pure nitrate of soda was found to be somewhat caustic to the plant, therefore the quantity of this material used was halved.

TABLE 2.—THE EFFECT OF FERTILIZER ON EGGPLANT WILT.

Fertilizer	Incubation period		Per cent disease
	Shortest	Longest	
Nitrate of soda	30	47	62.5
Superphosphate	29	56	87.5
Muriate of potash	19	37	100
4–8–4	21	35	100
4–4–8	25	39	100
4–8–8	22	43	100
4–4–12	21	35	100
Control	15	31	100

The plants were potted on March 25, the first application of fertilizer made on March 28 and three subsequent weekly applications were made before the plants were inoculated. After inoculation four additional applications were made, the last on May 29. In each of the first three applications 1 gram of available food material was added and in the last five, 2 grams.

The group treated with pure nitrate of soda showed 62.5% diseased plants but the remaining three plants died as a result of the treatment. One plant of the superphosphate group showed no symptoms at the conclusion of the experiment, July 4th, and all remaining plants succumbed to the disease.

The Application of Fungicides to the Soil

In the endeavour to discover some means for controlling this disease, it was thought possible that a fungicide might be found which, when added to the soil, would interfere with the activities of the pathogen.

Considerable research has been conducted in this connection with maladies caused by soil inhabiting parasites with various degrees of success. Williams (*20*), when working with Verticillium wilt of tomatoes tried many chemicals, some of which showed beneficial results.

As an introduction to these studies, a number of fungicidal chemicals were tested to determine their killing effect on the eggplant wilt pathogen in culture. The procedure followed was to flood cultures of the fungus growing in test tubes on potato dextrose agar with different concentrations of these chemicals, and to make transfers from these tubes at various intervals to new slants of culture medium to ascertain whether or not the organism was still alive.

The following self-explanatory table gives a resumé of the results obtained.

TABLE 3.—THE KILLING EFFECT OF CHEMICALS UPON THE EGGPLANT WILT FUNGUS IN CULTURE.

Compound	Percentage strength of solution	Length of treatment in days	Per cent killing effect
Lime sulphur	5	7	50
Sodium chloride	10	7	0
Cheshunt compound*	1	1	100
Calcium chloride	10	7	0
Copper sulphate	5	1	100
Calcium monosulphide	5	7	0
Ferrous sulphate	5	7	0
Aluminum sulphate	10	7	0
Zinc sulphate	5	7	0
Iron oxide	5	7	0
Phenol	10	1	100
Phenol	1	7	0
Formalin	1	1	100
Mercurous chloride	.5	4	100
Mercuric chloride	.05	2	100
Yellow mercury oxide	.25	4	100
Semesan	.1	2	100
Copper carbonate	5	4	100
Paradichlorobenzol	Conc. atmos.	84	0

*This material is prepared by grinding and thoroughly mixing together 2 parts copper sulphate crystals and 11 parts ammonium carbonate and allowing the mixture to stand 24 hours before use.

The compounds which proved to be fungicidal in the foregoing tests were applied to the soil in which eggplants were growing in order to ascertain the quantities which could be applied to a plant without materially affecting its growth.

To plants growing in 9-inch pots of unsterilized soil 100 c.cs. of each solution were applied at bi-weekly intervals for a period of seven weeks, or until the plants had been killed. At the end of this time, all remaining specimens with the exception of the checks were inoculated with the pathogen and infection results recorded.

In addition to the above, several series of control tests were carried out with a variation in both the strengths and quantities of chemicals used, in order to determine the efficacious applications.

The data recorded from these investigations showed that copper sulphate phenol and formalin could not be used on account of their toxicity to the host. Only mercuric chloride, mercurous chloride and yellow oxide of mercury showed definite possibilities for controlling the disease but the latter two had to be disregarded on account of their high cost, leaving mercuric chloride as the only substance tested which could be used as a commercial means of control.

In testing mercuric chloride four series of greenhouse experiments were carried on with equally promising results, only one of which will be described in detail here.

The eggplants used were grown throughout the experiment in steam-sterilized soil. Seed of the New York Purple variety was used and when the plants were about 4 inches high, they were transplanted to seven-inch pots. The inoculum was added to all pots, with the exception of the control block, one week prior to the inception of the experiment in order to simulate natural conditions as nearly as possible. Each mercuric chloride application was administered as 200 c.cs. of a one-fifth per cent solution of the chemical in water poured on the surface of the soil in the pot.

The treated portion of the experiment was divided into four series 1, 2, 3 and 4, corresponding to the number of applications of chemical each pot was to receive. Each of these series was again divided into four groups, A, B, C and D. In series 1, A received the application immediately prior to setting out the plants and B, C and D respectively, three, seven and fourteen days after transplanting. In the remaining three series all plants received one chemical application immediately prior to setting out the plants and additional ones at, (A) semi-weekly, (B) weekly, (C) fortnightly, and (D) three-week intervals thereafter. Series 5 and 6 were inoculated check and uninoculated control respectively.

Daily observations were made to record the appearance of wilt in order to determine the retarding as well as the controlling effects of the various groups of treatments.

An examination of the results above shows that there was a slight degree of control obtained where a single application of the chemical was made immediately prior to setting out the plants, 1A, but where the application was delayed for even as short a time as three days, infection had apparently occurred before the chemical had been added, 1B, 1C and 1D. In the cases

TABLE 4.—RESULTS OBTAINED IN CONTROLLING EGGPLANT WILT BY THE APPLICATION OF VARIOUS QUANTITIES OF MERCURIC CHLORIDE TO THE SOIL.

Treatment	No. of plants	Days between planting and final treatment	Incubation period in days		Per cent healthy plants
			Shortest	Longest	
Control	20	—	75	86	70
Check	12	—	19	30	0
1A	8	—	64	82	37.5
1B	8	3	21	38	0
1C	8	7	19	29, 82*	0
1D	8	14	17	28	0
2A	8	3	73	82	75
2B	8	7	45	87	62.5
2C	8	14	82	82	75
2D	8	21	45	87	50
3A	8	7	61	86	62.5
3B	8	14	82	—	87.5
3C	8	28	75	86	75
3D	8	42	—	—	100
4A	8	10	86	—	87.5
4B	8	21	86	—	87.5
4C	8	42	48	—	87.5
4D	8	63	20	86	62.5

*In this case, seven of the plants had become diseased after 29 days, but for some reason the eighth plant did not exhibit disease symptoms until 82 days after inoculation.

where more than one application was made, a definite measure of control was obtained. The results are fairly constant but there is a slight increase in control shown in the three and four treatment series over that which received only two. Also in two groups, 2D and 4D which received applications at 3-week intervals there was an increase in disease over other members of the groups which had received the same amounts of the chemical with the treatments at closer intervals. Again it will be noticed that in the series which received multiple applications and where some infections occurred, most of the disease appeared a considerable time after the final addition of the fungicide.

Hurst and Howatt (*13*), have shown that the fungicidal effect of mercuric chloride is considerably reduced by its chemical reaction with the soil and since there must have been a certain measure of contamination of the pots from outside sources, as shown by the fact that 30% of the control plants became diseased, it is probable that the majority of the infections in plants which received more than one treatment took place after the mercuric chloride in the soil had been reduced to such an extent that its action was no longer fungicidal.

An experiment similar to that just described was carried on under field conditions using 24 plants in each plot. The quantity of the chemical added in this case, however, was 300 c.cs. per application, an increase of 50% over that applied in the greenhouse. Immediately before the solutions were added to the soil, depressions about four inches in diameter were made around the bases of the plants in order to concentrate the chemical in the vicinity of their roots. The same number of plots was used as in the greenhouse and the number of, and intervals between the chemical treatments were identical.

Although the field was known to be heavily contaminated with the wilt fungus, 18 of the 24 plants in each plot were artificially inoculated. As the

experiment progressed and the results were recorded no visible difference appeared between the two sections; therefore in the compilation of the final results they were not separated.

Weekly observations on the presence of disease in the plots were commenced on July 3, three weeks after the inception of the experiment but the first symptoms of the disease did not appear until one week later. In Figure 3, the additional plants showing symptoms of wilt during each week are recorded as having wilted after an equal incubation period.

The results obtained from the field experiment as illustrated in the graph show that there was a definite retarding effect upon the progress of the disease where even a single application of the chemical was made prior to setting out the plants. Where the application was not made until after transplanting, 1B, 1C and 1D, a large amount of disease developed early in the growing period. Additional applications of the chemical after planting showed an increased retarding effect except in two cases 2D and 3D where there was a lapse of three weeks between treatments. It seems possible that the crop may derive some benefit from the application of mercuric chloride solutions around the bases of the plants immediately after periods of cultivation or heavy rainfall when the distribution of inoculum is most liable to take place.

Biologic Control

During the past two years a large number of isolations of soil inhabiting organisms have been made. Each of these which showed an antagonistic reaction towards Verticillium when grown with it in Petri dishes was saved and recultured for use in the experiments. The fungous organisms were grown on sterilized oat hulls in 125 c.c. Erlenmeyer flasks while the bacteria were grown in tubes of potato dextrose decoction.

Before the young eggplants were planted into 8-inch pots of unsterilized compost the soil was treated by adding to each an inoculum composed of equal quantities of a suspension of Verticillium and the antagonistic organism. The seedlings were then set out and observations made on the dates of appearance of the disease. Twenty-six different organisms were used in the experiment, 17 of which were fungi and 9 bacteria, and 4 plants were inoculated with each organism. At the completion of the experiment after ten weeks, four organisms showed control to the extent of 25%, while the inoculated checks showed 100%, and the controls 77% infected plants.

An experiment similar to the one described above was carried out by using seed instead of young plants in the pots but there was such a variation in the percentage of germination which might have been due to infection by the pathogen at an early date, that it was impossible to determine the accurate percentage of the disease present.

The results obtained from these experiments at least suggest that by the utilization of an improved technique some measure of biologic control may be obtained.

Control Recommendations

1. Obtain seed from disease-free plantations.
2. Sterilize seed before it is planted.
3. Grow all plants in sterilized soil from the time the seed is planted until it is set out in the field.

4. Do not plant eggplants in locations where Verticillium susceptible hosts such as raspberries, tomatoes, potatoes, etc., have been grown, without a lapse of several years, but have them follow some cereal, grass or green manure crop.

5. Remove all Verticillium susceptible hosts including tomatoes and potatoes as well as eggplants from the field and burn them before the ground is ploughed because the amount of the pathogen in the soil will be increased by turning under refuse from a diseased crop.

6. Never throw diseased plants on the manure or compost pile as this is an ideal method of contaminating an entire farm.

7. During cultivation, care should be taken to eliminate as far as possible the transportation of soil from locations where the disease is present to those where it has not been observed.

Summary

1. Wilt of eggplants is of general occurrence and no varieties known at the present time show any appreciable resistance to the disease.

2. The symptoms of the disease have been given in detail.

3. The disease is caused by a fungus tentatively identified as *Verticillium Dahliae* Kleb.

4. The pathogen is a vascular parasite and may be isolated from all parts of the plant including the seed.

5. The definite pathogenicity of the organism has been established.

6. The organism will grow between the temperatures of 8°C and 34°C, and within the range of pH 2.3 and pH 9. Optimum growth, however, occurs between 21°C and 24°C and above pH 5.4.

7. Vascular discoloration has been observed in the roots, main and secondary stems, leaves, fruit pedicels and fruit, though it need not always show in all parts of a diseased plant.

8. The pathogen is capable of producing the typical wilt in plants at soil temperatures between 11°C and 30°C but not at 35°C.

9. The application of different fertilizers had no controlling effect on the disease.

10. The addition of a solution of mercuric chloride to the soil prior to setting out the plants, with additional subsequent applications, showed definite control under greenhouse conditions and a considerable retarding effect upon the progress of the disease in the field.

11. Applications to the soil of cultures of organisms which show an antagonistic reaction to Verticillium in vitro have not yet proved effective as a means of control.

12. Control recommendations have been suggested.

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STUDIES ON THE MALTING QUALITY OF BARLEY

T. J. Harrison[1]
Board of Grain Commissioners for Canada, Winnipeg, Manitoba
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I. The Effect of Location on the Malting Quality of Barley[2]

In Europe, particularly in England and Germany, the maltsters have the land zoned into districts according to the quality of the malting barley that is produced. In Canada the zoning of the country has never been publicly undertaken although certain malting organizations in Western Canada select their barley by the carload, and no doubt location is a factor in making their selection.

When the Manitoba Barley Research Laboratory was organized by the Manitoba Department of Agriculture at the Agricultural College, the study of the effect of location on the malting quality of barley was one of the first investigations undertaken by the Agronomy Department.

The object was to determine the areas in Canada, and particularly in Manitoba, best suited for the production of barley to fulfill the requirements of the Canadian maltsters. The barley was grown by the Dominion Experimental Farms under the direction of Mr. L. H. Newman, Dominion Cerealist, by the different Universities under the direction of their plant breeders, and by individual farmers in Manitoba, under the direction of the author. The tests were made in the Barley Research Laboratory. The tests made were those outlined in a previous publication by the author (*2*).

The varieties used consisted of the standard six-row and two-row sorts, i.e. O.A.C. 21, Trebi, Hannchen, Canadian Thorpe and similar varieties.

Comparison of Provinces

In Prince Edward Island there was little to choose between the stations; Glenwood however, was slightly superior to Charlottetown. On the whole the barley from the Island was of remarkably high quality, of good germination and growth and high in extract.

The samples from Nova Scotia grown at Nappan, whilst of good quality, were not equal to the samples from the Island.

The Quebec samples were of excellent quality, slightly better than Nova Scotia, but not equal to Prince Edward Island. The samples from St. Anne de la Pocatière were very low in protein but the extract was not quite as high as at Cap Rouge. There was little choice therefore, between the different areas in Quebec.

The Ontario barley was somewhat inferior to the Quebec barley, being thicker in the hull, higher in protein and lower in extract. It should be noted however, that no samples were tested from the Bay of Quinte area in Ontario. The Ottawa samples were much higher in protein than either Kapuskasing or Russel. The Russel samples were fair in extract, while the Kapuskasing samples were thicker in the hull.

[1] Assistant Commissioner for Manitoba.

[2] This investigation should be considered only a preliminary study; it has not extended over a long enough period or been complete enough in the points and varieties tested. It does however, give some indication of the areas best suited for the production of good malting barley and of the varieties best suited for the malting industry.

The Manitoba tests are about equal to Ontario with the Swan River samples distinctly superior, being low in protein, high in extract, and of good germination and growth.

The Saskatchewan samples were inferior to Manitoba; the protein is very much higher, and the extract is very much lower. Comparing the stations Kamsack is the best, Swift Current the poorest, with Indian Head and Rosthern coming in between.

In Alberta the best barley was produced in the Northern portion. In this area Beaverlodge and Fort Vermilion were low in hull but high in protein In this respect they were better than Saskatchewan but not quite equal to Manitoba. The extract was fair but not as high as in some of the other Provinces, including Manitoba and the Maritimes.

As one would expect the samples from the different sections in British Columbia are quite variable; taking the average they would be about equal to the Alberta samples. Agassiz barley was distinctly superior to that from the other stations; it was thin in the hull, low in protein and high in extract. Kamloops, on the other hand, was distinctly inferior. Vanderhoof also was poor, the barley in this case being very immature.

Comparison of the Crop Zones in Manitoba

In Manitoba a much more detailed study was made. Plots of O.A.C. No. 21 were grown by farmers under the supervision of the author in each of the crop zones.

The Inter-Lake area as represented by Ericksdale, produced an excellent quality of barley; the protein was low, the extract high, the hull was thin and the germination excellent. The Red River Valley (Winnipeg and Morden) gave barley of good quality; it was low in protein and fair in extract. The Southern Drift area (Crystal City and Killarney) was high in protein but were fair in extract. The Souris Plain (Deleau) was even higher in protein but had a good extract. The Carberry Plains (Carberry) gave an excellent barley equal to the Inter-Lake barley, being very low in protein and high in extract. In the Central Drift (Brandon) the quality is poor, the protein is high, extract low and germination poor. The Northern Drift (Birtle) is poor, the protein is very high and the extract low, although the germination is good. In the Riding Mountain Wash (Plumas) the quality is again good. The Valley between the Riding Mountains and the Porcupine Hills (Gilbert Plains) is also good. Swan River Valley, however, produces the best quality of barley in Manitoba.

Summary

Taking Canada as a whole, the indications are that Prince Edward Island would produce the best barley in the Dominion, and that a fair quality can be produced in the other Eastern Provinces. In British Columbia the quality is variable, depending on the soil and climatic conditions of the different valleys. On the prairies, Manitoba produces the best quality although fair quality can be grown in the Northern sections of both Saskatchewan and Alberta. In Manitoba the Eastern and Northern parts give the best results.

II. Barley Varieties and Malting Quality

The maltster evaluates barley according to the following factors (*2*); (a) cost of preparing the barley for malting, i.e. cleaning, grading, drying, etc.; (b) ease of malting, i.e. percentage and uniformity of germination, absence from mould,etc.; (c) quantity of malt produced from a bushel of barley, i.e. plumpness, and size of kernels, thickness of hull, etc.; (d) quality of malt produced, i.e. amount of malt extract, protein content, diastatic activity, etc. In a study of the malting quality of varieties the first two factors should be given only cursory consideration because they are due primarily to environmental conditions and cultural practices. The last two however, are all important because they are due to the heriditable qualities of the variety.

The experimental study of the malting quality of barley varieties was undertaken by the author in 1925, in the Barley Research Laboratory established by the Manitoba Department of Agriculture at the Agricultural College, Winnipeg.

Previous to this the Canada Malting Company had tested varieties grown at different points in Canada and published the results in the form of annual reports (*2*). For their purpose they found O.A.C. 21 the most desirable variety. In 1925 the following varieties were grown on the agronomy field at the Agricultural College: Manchurian Group—O.A.C. No. 21, Chinese, Manchurian, Bearer; Mediterranean Group—Trebi, Barks; Duckbill Group —Canadian Thorpe. They were tested by the author and Mr. J. P. Grant, Plant Superintendent in the Canada Malting Company's malt-house in Winnipeg. The method consisted in weighing out 12 ozs. of barley, placing it in a cylindrical cage and keeping the cage covered in a regular "piece" of malting grain in the malt-house. All determinations excepting protein were made at the plant. The methods used in the later studies are those outlined by the author in a previous paper (*4*). All calculations of determinations made on the grain excepting weight per measured bushel were on a 13.5% moisture basis, while the determinations on the malt are on the dry basis.

In the first year's test the Mediterranean Group was very low in protein, uneven in growth but very nearly as good in extract as the Manchurian Group. Everything considered the Manchurian Group gave the best results.

In 1926 the varieties were again grown on the experimental field of the Agronomy Department at the Manitoba Agricultural College. Three new varieties were added to the list. Mr. P. Stewart, Secretary of the Canadian Seed Growers' Association, supplied Plumage Archer and New Sunrise of the Chevelier Group, two varieties that were being introduced with considerable success in Great Britain. Duckbill, a two-row variety that had been giving good results on the Dominion Experimental Farms, was also included in the Duckbill Group.

That year the malting was done with improvised equipment in the Agronomy Laboratory at the Manitoba Agricultural College. In this test O.A.C. No. 21 again demonstrated its superiority among the Manchurian varieties, while the Plumage Archer and New Sunrise in the Chevelier Group gave most excellent results.

In 1927, Trebi, Duckbill, Hannchen and O.A.C. No. 21, representing the four groups, were tested out at several points in the province, in an endeavor to determine if certain varieties were better suited to certain districts. In this test there was considerable variation in the varieties at the different points, but the most striking result was the excellent extract that was obtained from Hannchen at all points. O.A.C. No. 21 gave the best germination. The protein and hull was variable but the Trebi was most often lowest in protein and highest in hull. The indications are that O.A.C. No. 21 will give the best malting results in the South and the Hannchen in the North.

In 1928, considerable interest was being shown in the British malting barley market; consequently, several new Mediterranean varieties were procured by Premier John Bracken while on a business trip to California, and a few Chevelier varieties were secured by the author from the maltsters in Great Britain. These, along with the standard varieties, were grown at Winnipeg. From an agronomic standpoint the Californian varieties were very disappointing. They were badly infected with disease and gave a poor yield per acre of inferior appearing barley. The malting was done on the equipment supplied by the Manitoba Department of Agriculture (*4*).

In the Mediterranean group the Trebi gave the best results, so that from the standpoint of either a home or export malting barley market the Mediterranean group is not promising. Among the Chevelier two-row group the Hannchen, Plumage Archer and New Sunrise gave good results. For uniformity and quick germination the O.A.C. No. 21 and Chinese stood at the top of the list.

In 1929, after the author had investigated the malt barley market in the United Kingdom and on the European Continent, many new varieties were added to those tested. It was hoped that by this practice a variety better suited to the overseas trade, and at the same time suitable to Canadian agronomic conditions, might be discovered. On this test a six-row variety of the Manchurian group called "July" was introduced from Ireland. While this variety did not give particularly good agronomic results, it was distinctly the best malting barley of the group. It gave a high extract, a quick uniform growth and was low in both hull and protein. The Regal (a variety introduced by the University of Saskatchewan) gave a very good extract but was uneven in germination.

Among the Chevelier two-row group the Hannchen again stood at the top of the list in extract and germination. Spratt Archer and Plumage Archer were also near the top.

In 1928 and 1929, several of the varieties were malted according to the English method; this consisted of the long germination period such as is secured by the floor method (*3*). This was done to determine which of the varieties would be best suited for the British trade. In this test the Chevelier two-row barleys gave the highest yield of extract. In this group Hannchen and Plumage Archer stood at the top. In the six-row class the Manchurian group gave the best results, although the Mediterranean group contained several of the Californian varieties such as Bay-brewing, Mariout, Hero, etc., which are ordinarily used by the British maltsters and brewers in their various blends.

The following is a list of some of the more common varieties tested: Six-Row, Manchurian Group -O.A.C. No. 21, Chinese, Manchurian, Bearer, Keystone, July, Regal, Plant's Selection, Confort, Minsturdi, Glabron, Wisconsin No. 38, Improved Manchurian, Danubian, Velvet, Star; Six-Row Mediterranean Group—Trebi, Berks, Vaughan, Atlas, Sacremento, Hero, Coast, Tennesse Winter, Bay-Brewing, Mariout, Smyrna, Algerian; Two-Row Chevelier Group—Plumage Archer, New Sunrise, Hannchen, Norfolk Scotch, Scotch Plumage, Scotch Standwell, Swansota, Bevans' F 112, Spratt Archer, Golden Pheasant, Svalof Braze, Svalof Victory, Svalof Gold, Australian Chevelier, Charlottetown No. 80, Danish Island, German Brewing, Polish; Two-Row Duckbill Group—Canadian Thorpe, Duckbill, Archer Goldthorpe.

Summary

For the Canadian method of malting the Manchurian group of six-row barleys gave the best results. In this group the O.A.C. No. 21 and Chinese gave considerably better returns. The July, if it were a better agronomic barley, would have a place if grown in quantity. It would have to be grown in quantity, for having a white aleurone it could not be mixed with O.A.C. No. 21 or Chinese. The Mediterranean group was unsatisfactory although it included such renowned Californian varieties as Bay-Brewing, Mariout, etc.

Among the two-row sorts the Chevelier group is distinctly superior to the Duckbill group. In this group the better varieties are Hannchen and Plumage Archer.

Under the floor method of malting such as is used in the United Kingdom, the same varieties gave the best results, namely, Hannchen and Plumage Archer among the two-row sorts, and O.A.C. No. 21 and Chinese among the six-row sorts.

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THE ANTIRACHITIC VALUE OF PILCHARD OIL (SARDINE OIL) FOR GROWING CHICKS

JACOB BIELY[1] and V. ELVIRA PALMER[2]
University of British Columbia, Vancouver, Canada

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In previous papers from this laboratory, Asmundson, Allardyce and Biely (*1*) and Asmundson and Allardyce (*2*) reported on the value of pilchard oil (*Sardinia cerulea*) or as it is known in California, sardine oil, as a source of Vitamin D. The literature has been already reviewed in the above papers. The purpose of the present paper is to report additional data on the antirachitic potency of various samples of pilchard oil produced in British Columbia.

MATERIAL AND METHODS

The properties of the pilchard oils and cod liver oils used in the following experiments are shown in Table 1. It will be seen that the pilchard oils were low in free fatty acids, ranging from 0.33% to 0.91%. Furthermore, the more refined oil was lower in free fatty acid than the ordinary commercial run of pilchard oil. Our data in this respect agree with those of Gutteridge (4), who reported that the free fatty acid contents of carefully prepared samples of pilchard oil and ordinary commercial pilchard oil were .60 and .89% respectively. In this connection it should be noted that Drummond (*3*) states that free acidity greater than 1.3% is undesirable in a feed oil.

The two medicinal cod liver oils used in these experiments were significantly lower in free fatty acid (.16 and .54% respectively) than the commercial cod liver oils used by Gutteridge (*4*), i.e., 2.16 and 3.69% respectively.

TABLE 1.—COMPARISON OF THE PILCHARD OILS AND COD LIVER OILS USED IN EXPERIMENTS 1 AND 2.

Oil	Lot	Free fatty acids as oleic Percentage	Lovibond blue units in 10% solution Percentage	Remarks
Pilchard oil	1	0.64	2.1	Ordinary commercial run of oil produced in August, 1932. Clear amber in colour. Kept in steel tanks containing 10,000 gallons. Sample drawn 1 foot below surface of oil.
Pilchard oil	2	0.91	2.4	Ordinary commercial run of oil produced in August, 1931. Clear amber in colour. Kept in steel tanks containing 10,000 gallons. Sample drawn 1 foot below surface of oil.
Pilchard oil	3	0.33	0.6	Special sample of oil produced in August 1932, by the same steaming process as used for tendering cod livers. Light straw color. Kept in 4-gallon tin container.
Cod liver oil (E)	4	0.16	5.0	Medicinal cod liver oil (E). Bottled.
Cod liver oil (A)	5	0.54	7.2	Mecicinal cod liver oil (A). Bottled.

[1] Research Assistant.
[2] Technical Assistant, Department of Poultry Husbandry.

In respect to the free fatty acid, it seems that the commercially produced pilchard oils compare favorably with medicinal cod liver oil.

The chicks used in these experiments (S.C.W. Leghorn and various cross-breds) were raised in battery brooders containing warm and cool compartments. The chicks were divided according to ancestry as evenly as possible into the respective lots. Mash and water were kept before the chicks all the time.

Experimental

Experiment 1 (Oct. 4, 1932)

A ration recommended by Hart, Kline and Keenan (*6*) was fed to the experimental chicks. The basal ration was mixed every two weeks with the various oils as follows:

Lot 1—1% pilchard oil produced in 1932.

Lot 2—control.

Lot 3—1% pilchard oil produced in 1931.

Lot 4—1% carefully refined pilchard oil produced in 1932.

Lot 5—1% medicinal cod liver oil. (A)

At six weeks of age five chicks (3 males and 2 females) from each of Lots 1, 3 and 4, and six chicks (3 males and 3 females) from each of Lots 2 and 5 were killed. The tibia and fibula of each chick were analyzed for ash by the method described by Hart *et al* (*6*). The data for the different lots are summarized in Table 2. With the exception of the control chicks, which showed rickets, the chicks in all lots appeared to be normal. It will be seen that mortality in all of the lots was low, and with the exception of the control lot, the average weights of the chicks were satisfactory. The ash analyses show that the pilchard oils used were equal in value to medicinal cod liver oil in promoting normal bone calcification.

TABLE 2.—EXPERIMENT 1.—COMPARISON OF WEIGHTS OF CHICKS RECEIVING 1% OF PILCHARD AND COD LIVER OIL AND ASH ANALYSIS OF TIBIA AND FIBULA.

Lot No.	Oil fed*	No. of chicks started	No. of chicks alive at 6 weeks of age	Average weight of chicks at 6 weeks of age grams	Average weight of 5 chicks killed for ash analysis: grams	Average per cent of ash in tibia and fibula of 5 chicks
1	Pilchard No. 1	20	17	318.5	358.0	42.04
2	Control	20	18	266.6	252.1†	33.25
3	Pilchard No. 2	20	19	333.7	358.2	41.64
4	Pilchard No. 3	20	18	321.5	328.0	42.45
5	Cod liver oil (A)	20	18	330.8	334.8†	43.37

* See Table 1.
† Note: 6 chicks.

Experiment 2 (Feb. 10, 1933)

For the second experiment the basal ration recommended by Gutteridge (*4*) was used. This ration is made up of ingredients usually employed in the preparation of commercial poultry mashes: shorts, middlings, yellow corn-meal and ground oat groats—22% of each; meat meal—6%; fish meal,

buttermilk powder and bone meal—2% of each; oyster shell. Since it was not convenient to feed the latter separately, 1% of finely ground oyster shell was incorporated in the mash. The basal ration was supplemented as follows:

Lot 1—1% medicinal cod liver oil (E).

Lot 2—½% pilchard oil.

Lot 3—1% pilchard oil.

Lot 4—control.

At six weeks of age five chicks (3 males and 2 females) were killed and analyzed for bone ash. The data are summarized in Table 3. With the exception of the control chicks the chicks in all lots grew at a very uniform rate. The chicks receiving pilchard oil and cod liver oil showed normal ash contents, while in the control chicks the percentage of ash was the lowest amongst the four lots.

TABLE 3.—EXPERIMENT 2.—COMPARISON OF WEIGHTS OF CHICKS RECEIVING PILCHARD OIL AND COD LIVER OIL AND ASH ANALYSIS OF TIBIA AND FIBULA.

Lot No.	Oil fed*	Per centage of oil fed	No. of chicks started	No. of chicks alive at 6 weeks of age	Average wt. of chicks at 6 weeks of age grams	Average wt. of 5 chicks killed for ash analysis—grams	Average per cent of ash in tibia and fibula of 5 chicks
1	Cod liver oil (E)	1	14	14	361.4	320.8	43.53
2	Pilchard No. 3	.5	13	13	366.0	317.6	42.11
3	Pilchard No. 3	1	13	12†	389.3	383.2	43.65
4	Control	None	14	14	267.4	265.0‡	33.21‡

Note: * See Table 1.
† Chick killed—slipped tendon.
‡ 8 chicks.

Discussion

The results obtained in these experiments agree with those of previous investigators, that pilchard oil is equal to medicinal or commercial cod liver oil in promoting normal bone development. The data further indicate that chicks receiving ½% of pilchard oil showed normal growth and bone development comparable to that of chicks receiving 1% medicinal cod liver oil. Whether smaller doses than ½% would be sufficient to prevent rickets is a matter for further trials. It is quite apparent from these experiments that the ordinary run of commercial poultry pilchard oil is equal in Vitamin D value to the carefully refined pilchard oils. It is also apparent that pilchard oils stored for a year or more under proper conditions do not deteriorate in quality. The results obtained by Asmundson and Allardyce (*2*), by Gutteridge (*4*), and by ourselves, seem to indicate that the pilchard oils produced in British Columbia are a good source of Vitamin D.

Gutteridge (*5*) has recently shown that pilchard oil is also a source of Vitamin A. Although the colorimetric test (Lovibond blue units) is not an exact criterion of the Vitamin A contents of pilchard oil, it is interesting to note that the pilchard oil used by Gutteridge in his Vitamin A studies contained 2.20 Lovibond units, which equals the number of Lovibond units

contained in samples 1 and 2 of this series. It should be noted, however, that samples 3, Table 1, showed the lowest colorimetric rating. This oil (sample 3) was prepared from a specially light colored pilchard oil.

A comparison of the two cod liver oils shows that, when fed at a 1% level, they are equally potent in antirachitic properties. However, as judged by the colorimetric test, these oils show a difference in Vitamin A contents. Thus "E" oil contained 5 Lovibond units as compared with 7.2 Lovibond units in the "A" oil. Since a colour value of less than 5 Lovibond units indicates an oil of low Vitamin A potency, it would appear that the "E" oil is not a good source of Vitamin A, while the "A" cod liver oil slightly exceeds the minimum limit of 7 units stated by Drummond (*3*) to be desirable. The low Vitamin A contents of the two cod liver oils, as judged by the colorimetric test, is quite surprising in view of the fact that both oils were biologically tested to ensure a high concentration of the fat-soluble Vitamins A and D. It is obvious, therefore, that the various oils used both in the feeding of livestock and of children need to be carefully standardized before they are placed on the market.

Summary

Chicks fed a basal ration, lacking Vitamin D, which was supplemented with commercial pilchard oil at ½% and 1% levels, showed practically the same ash analysis as chicks fed similar rations which were supplemented with 1% of the medicinal cod liver oils.

Acknowledgment

The writers wish to express their great indebtedness to Mr. F. D. Mathers, who supplied the various pilchard oils for experimental purposes. The acidity test and colorimetric assay were made through the courtesy of Dr. F. T. Shutt, Dominion Chemist.

Addendum

In conjunction with Experiment 1, one lot of chicks (12 chicks) was exposed at a distance of 10 inches to two 60-watt CX Mazda lamps in the warm compartment of the battery brooder. These lamps, together with one carbon lamp, acted also as a source of heat, and therefore were in use twenty-four hours daily. Since the chicks spent part of the time in the cool compartment, they were probably not exposed to the ultra-violet rays of the CX Mazda lamps for more than 12 to 14 hours a day.

At the end of six weeks the chicks weighed 327.6 grams, or practically the same as the chicks in Experiment 1. The average weight and the average ash contents of the tibia and fibula of the five chicks which were analyzed were 325.4 grams and 42.55 per cent respectively. Since the average ash analysis of the irradiated chicks was nearly the same as the average ash analysis of the chicks receiving pilchard or cod liver oil, it is concluded that in this trial the CX Mazda lamp was a satisfactory source of Vitamin D. This is in agreement with the data of Miller, Bearse and Cushing (Poultry Science, Vol. 12, No. 1, pp. 21-22, 1933), who report that chicks exposed over 7 hours a day at a distance of 10 inches to CX Mazda lamps showed normal bone calcification.

The authors are greatly indebted to Mr. S. J. Bowman, Agricultural Representative of the B. C. Electric Railway Company Limited, Vancouver, B.C., for the installation and use of the CX Mazda lamps.

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CURRENT PUBLICATIONS

THE EFFECT OF WINTER EXPOSURE IN THE STOOK ON QUALITY OF WHEAT. R. K. Larmour, J. G. Malloch and W. F. Geddes. Canadian Journal of Research *9:* 252-260.

Samples of wheat were exposed in the stook over winter and threshed in the spring in two seasons. These spring-threshed samples were compared with check samples from the same lots that had been threshed in the fall. The exposed samples lost grade in 50% of the cases, and decreased in weight per bushel in practically all cases. The flour yield was generally increased slightly as a result of the winter exposure. In respect to baking quality 22% showed improvement and 40% showed damage. The changes in grade and bushel weight do not correspond very closely with changes in baking behaviour.

ELECTROLYSIS OF SEED OF CEREALS

J. G. C. Fraser[1] and L. M. Pidgeon[2]
Central Experimental Farm and National Research Laboratories, Ottawa.

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Introduction

For a number of years there has been available a group of patented processes for the treatment of seeds prior to sowing, known collectively as the "Wolfryn Electro-chemical Process". A fairly wide range of treatments is described in patents covering this process, associated with the names of C. E. DeWolf and H. E. Fry. In certain cases soaking the seeds in various solutions was stated to increase their productivity; in other descriptions, electrolysis was called for. Various subsequent treatments are described such as sprinkling the seed with petroleum, lime, etc., after which it is sown in the customary manner.

The process has been stated to increase the yield per acre, to increase resistance to inimical bacteria, and to produce seed of better quality. Should these claims prove to be sound, the importance of the process to an agricultural country is obvious, hence it seemed worthy of careful examination. This paper describes the laboratory and field tests carried out on the Wolfryn process. The electrochemical treatment was given at the National Research Laboratories, Division of Chemistry, while the field tests were carried out by the Dominion Experimental Farms, Cereal Division, and by the Federal Branch Farms at Fredericton, N.B., and Charlottetown, P.E.I.

Part I. Description of Process and Experimental Treatments

L. M. Pidgeon

The process as described in patents

Before discussing the methods employed in the present research it is of interest to review some of the descriptions of the process which have appeared in the patent literature.

Canadian patent 156241 taken out in 1914 by C. E. DeWolf describes the improvement of seeds by placing them in a solution of manure through which an electric current is passed. The seeds may subsequently be sprayed with petroleum or benzine.

A later patent, Canadian 179503, taken out in 1917 to C. E. DeWolf and H. E. Fry claims to improve the seed by steeping in radioactive water. The time of steeping depends on the seed, being 24 hours for wheat, 36 hours for barley and oats, and 48 hours for maize. These times may be shortened to 3, 4, and 5 hours respectively by passing a current between electrodes fixed at each end of the bath, (that is, the electrolysis is purely incidental and the essential part of the treatment may exist without it.) If the water is not naturally radioactive, it is made so by exposing it to emanation. This patent also includes steeping the seeds in a solution of manure and radioactive water. After any of these treatments the seed is dried and may be sprinkled with petroleum or benzine. A number of permutations and combinations of the above are included in the patent.

[1]Chief Assistant, Cereal Division, Central Experimental Farm, Ottawa.
[2]Assistant Research Chemist, National Research Laboratories, Ottawa.

British patent 102081, 1916 to DeWolf and Fry is essentially similar to that described above in that electrolysis is incidental. "According to this invention the seeds are steeped before they are sown in natural mineral waters similar to those which are used for therapeutic purposes, and which contain solutions of nitrogen, chlorine, and other gases and small quantities of metallic salts, after which the seeds are sown as promptly as possible." Electrolysis is mentioned as shortening the time of steeping. Radioactivity is not mentioned.

The essential point of these various methods is the soaking of the seed in certain solutions prior to sowing; electrolysis in most cases is mentioned as an accessory. However when we examine the work which has been done previously on the subject, together with later specifications it appears that electrolysis is the essential feature and the solution may be ordinary saline (NaCl).

An enthusiastic and very popular account of the process is given in "A Manual of the Electrochemical Treatment of Seeds" by Charles Mercier M.D. (University of London Press 1919). In this account electrolysis is represented as being the important factor; soaking is effective but to a lesser degree. The process calls for immersion of the seed in 2% to 5% sodium chloride solution through which a current is passed between iron electrodes. After electrolysis the seed is drained and dried at 100° F. No subsequent treatments are described but immediate sowing is recommended.

The author admits the lack of quantitative data on the merits of the process but states that very favorable reports were obtained from the 150 farmers who employed the treatment in 1918.

The electrical units given in the text and other remarks of the author exhibit a failure to appreciate the significance of the laws of electrolysis. The term "electrification" is used for electrolysis throughout. The possible reactions at the electrodes are not discussed, nor does the author appear to be aware of their existence, except perhaps in one place where he mentions that iron electrodes produce better results than carbon. It is obvious that a different chemical solution is produced by these procedures containing ions of very different character, so that one would expect differences in behaviour. This matter will receive further discussion below.

PREVIOUS INVESTIGATIONS OF THE PROCESS

Dr. E. J. Russell[1], director of the Rothamsted experimental station has described a number of experiments carried out at Rothamsted and elsewhere in England during 1918-1919. The treatment used in these experiments followed details given in the "Manual of Electrochemical Treatment of Seeds" described above. The seeds are placed in a 2-5% sodium chloride solution through which a current is passed between iron electrodes. After treatment the seed was dried at 100°F. The subsequent examination was by means of pot culture. Treated and untreated seed was planted in pots both manured and unmanured. The results may be briefly summarized as follows.

Out of 14 measurements made in 1919, four were in favour of the process, eight were unfavourable. Two months had elapsed between treatment and sowing in this case and to remove this possible objection, the experiments

[1] E. J. Russell, Journal of the Ministry of Agriculture, Vol. XXVI, p. 971. 1920.

were repeated at Oxford under circumstances where but one month elapsed. The results in this case were more favorable but no definite trend was noticeable. (In the experiments to be described in this paper the sowing took place within 4 to 7 days of treatment.) Measured field tests were mentioned, carried out at South Eastern Agricultural College, Wye. In these tests no difference could be detected between the treated and untreated seed. A number of farm tests were mentioned, some of which appeared to be successful; however, as in most cases no precautions were taken to ensure accurate collection of data, and as only a fraction of the farmers reported at all, the author does not place much reliance on these trials. Based on his own experiments and those of others, the author classified the process among those which are occasionally successful but are greatly inferior to manuring which is almost invariably successful in increasing the yield.

EXPERIMENTAL WORK

The seed treatment which has been followed in this work is based on details supplied by A. W. DeWolf, of Montreal, and which are assumed to represent the preferred practice of the inventors. It is completely an electrochemical process, i.e. there is no mention of therapeutic, or radioactive waters. The importance of current density during electrolysis is appreciated and sufficient details are given for an accurately controlled process. The description is summarized below.

WOLFRYN ELECTROCHEMICAL PROCESS

1. The grain is to be placed on rectangular tanks of wood or brick of the following general dimensions: 8 ft. by 4 ft. by 2½ ft. The ends of the tank are covered by iron plates of ⅛ inch thickness which act as electrodes. (Any suitable container is stated to be satisfactory for small tests.)

2. A 2½% solution of sodium chloride is added. The grain is to be covered by the solution; 5 gallons of solution per bushel of grain is recommended. The seed is allowed to soak for two hours in this solution being turned over occasionally.

3. A direct current is passed between the electrodes; 2 amperes per square foot of the active surface of one of the electrodes is called for. The following times are required by various seeds:

Wheat and Rye.....	3½ hours	The seed is to be stirred occasionally during electrolysis.
Oats	4½ "	
Barley and Maize....	7 "	

4. The grain is left to soak in the resulting solution for about 16 hours.

5. The solution is then run off until the seed is well drained, after which it is removed from the tank and spread upon a floor until excessive moisture has disappeared. (The depth of the grain should not exceed 4 to 6 inches.)

6. The seed is sprinkled with slaked lime, as fine as flour, until the whole is coated with the lime. It will be ready for sowing in about 24 hours, but may be kept on the floor without detriment for some weeks provided it is turned over occasionally.

It was decided to restrict the trial to wheat only, and to attempt to examine the significant features of the process. These are briefly:

1. Soaking in NaCl solution.
2. Electrolysis between iron electrodes.
3. Sprinkling with lime.

In view of the fact that the use of iron electrodes in a sodium chloride solution produces iron chloride in solution during electrolysis, it was decided to examine an additional replicate employing carbon electrodes.

The sample of Huron wheat obtained from the Central Experimental Farm was accordingly divided into five lots which are designated A, B, C, D, and E throughout.

Details of Treatment.—Glass battery jars 9 inches by 5⅛ inches by 5⅛ inches were employed as containers. Clean iron electrodes were placed in the ends of A and B. Graphite electrodes were used in the case of C. The seeds were stirred from time to time with wooden paddles.

The three electrolytic cells were connected in series and direct current passed from a full-wave valve rectifier operating on 110 volts 60 cycle. A current of 110 milliamperes was passed through the solutions, which conforms to the current density called for in the description given above.

The actual treatment received by each sample was as follows:

A. 1. Soaked in 2½% NaCl solution for 2 hours.
   2. Current passed between iron electrodes (14 milliamps. per sq. inch. of electrode) for 3½ hours.
   3. Soaked in same solution for 16 hours.
   4. Dried on a flat surface at room temperature for 24 hours.

B. 1. Soaked in 2½% NaCl solution for 2 hours.
   2. Current passed between iron electrodes for 3½ hours. (14 milliamps. per sq. inch of electrode surface).
   3. Soaked in the resulting solution for 16 hours.
   4. Dried as above for 24 hours.
   5. Sprinkled with fine lime.

C. 1. Soaked in 2½% NaCl solution for 2 hours.
   2. Current passed between graphite electrodes for 3½ hours. current density as above.
   3. Soaked in the resulting solution for 16 hours.
   4. Dried as above for 24 hours.
   5. Sprinkled with fine lime.

D. 1. Soaked in 2½% NaCl solution for 21½ hours.

E. Untreated, for control.

Discussion of Treatment.—Samples A and B have received treatments which conform as nearly as possible to the description which was supplied by A. W. DeWolf, except that in the case of A the lime treatment has been omitted. It is obvious that with iron electrodes in NaCl, a direct current will produce solution of the iron at the anode. Ferric or ferrous chloride will be produced depending on the current density, in the present case probably the latter. Caustic soda is produced at the cathode. This solution of iron caused a darkening of the electrolyte and caused the seeds to lose their yellow colour and assume a green-grey colour.

In the case of sample C inert electrodes were employed. In this case chlorine was produced at the anode and NaOH at the cathode. The mechanical stirring resulted in considerable mixture, hence in this case the treatment was practically equivalent to soaking in sodium hypochlorite solution. No bleaching was noticeable; the seeds appeared unchanged after the treatment.

Sample D was soaked in sodium chloride solution of the same strength as that employed for the electrolysis and for the same time. This procedure was followed in an endeavor to separate the effect of electrolysis and of soaking in a chemical solution.

It will be seen from the results to be described in the second part of this paper that all of these treatments gave lower yields than the untreated seed and that no significant difference was obtained between A and B; hence in this case the lime sprinkling had no effect. Sample C in general was inferior to the other treated samples, hence the sodium hypochlorite has a detrimental effect in this case. Sample D which was soaked without electrolysis gave results very similar to A and B. Hence no advantage has been gained by any treatment. This is in agreement with the results of the Rothamsted experiments.

Part II. Germination and Field Trials

J. G. C. Fraser

Methods

For field trials the seed used was wheat of the Huron Ottawa 3 variety, Elite stock being secured by the Cereal Division and this carefully graded over a screen having round perforations 8/64 inch. in diameter. A total of eight pounds was prepared as above and this material was sent to the National Research Council for treatment prior to seeding, the Cereal Division not being equipped to provide the particular treatment involved.

Following the treatment of the seed, it was sent to the Cereal Division, Ottawa, the Experimental Station at Fredericton, N.B., and the Experimental Station at Charlottetown, P.E.I., for yield tests.

Field tests by Cereal Division, Ottawa

The treated seed was received from the Research Council on May 14th, 1932, and consisted of five lots, designated A, B, C, D and E. The first four lots were treated in different ways, outlined in Part I, the fifth lot being left untreated as a check or "control". In addition to these lots, it was thought advisable to include another lot taken from the same original bulk lot and which had been immersed in water at 16° C (70°F) for eight hours, but which had received no other treatment. This sixth lot was designated F. The plots devoted to the test were located on well prepared land of reasonably uniform quality. Seeding took place at Ottawa on May 17th, 1932, and harvesting on August 25th.

Germination.—Careful counts were made of the number of plants produced in all plots in order to avoid possible errors due to differences in stand. In Table I will be found the actual number of plants produced, together with the mean for the four plantings in the case of each lot.

TABLE 1.—FIELD GERMINATION COUNTS

	A	B	C	D	E (untreated)	F (soaked only)
Rep. I	283	260	244	262	361	310
Rep. II	263	274	238	239	328	309
Rep. III	244	237	245	247	338	324
Rep. IV	262	271	244	270	333	391
Mean	263	260	242	254	340	333

Tillering.—Among other field observations, the nature of tillering or "stooling" was noted. This was recorded as uniform for all plots. In the early part of July there appeared areas in the first three replicates which gave evidence of stunted growth. In order to evaluate the magnitide of variation or error produced owing to this peculiarity the probable error was calculated. The following figures illustrate the P.E. in per cent of the yield, 1000 kernel weight, and length of straw for the B plots for the four replicates, as well as the unaffected plots.

TABLE 2

		Difference
P. E. of yield for unaffected plots	= ± 5.41	± 4.11
P. E. of yield for all plots	= ± 9.52	
P. E. of 1000 kernell wt. for unaffected plots	= ± 2.97	± .13
P. E. of 1000 kernell wt. for all plots	= ± 2.84	
P. E. of length of straw for unaffected plots	= ± 6.06	± 4.01
P. E. of length of straw for all plots	= ± 2.05	

It so happened that one of each treated and check plot had affected areas. Possibly B was most seriously damaged, consequently it was deemed advisable to make a correction by multiplying the difference in the probable error by the yield of each B plot. (Hayes and Garber method).

TABLE 3.—COMPARATIVE YIELDS IN LBS. PER ACRE

	B's P. E. correction	B. not corrected	Checks	
			E (Dry)	F (Wet)
Rep. I	1605.3	1542.0	1985.8	1909.6
Rep. II	2410.9	2315.8	2558.1	2040.8
Rep. III	2047.9	1967.1	2268.0	2354.3
Rep. IV	2078.6	1996.6	2353.3	2051.6

The entire experiment ripened uniformly and took approximately 100 days to mature. In Tables 4, 5, 6 and 7 are given the yields in lbs. per acre presented according to Stations—Ottawa, Fredericton and Charlottetown. The data have been analysed statistically using Fisher's variance method and the results obtained are given in Table 8.

TABLE 4.—YIELDS IN LBS. PER ACRE.—OTTAWA

	A	B	C	D	E (Dry)	F (Wet)
Rep. I	1861.0	1542.0	1672.1	1600.0	1985.8	1909.6
Rep. II	1897.5	2315.8	1977.5	2455.8	2558.1	2040.8
Rep. III	2061.8	1967.1	2080.0	2078.6	2268.0	2354.3
Rep. IV	2308.0	1996.6	2048.6	1782.0	2353.3	2051.6
Mean	2032.0	1954.3	1669.5	1979.1	2291.3	2089.0

TABLE 5.—YIELDS IN LBS. PER ACRE.—FREDERICTON

	A	B	C	D	E (Dry)	F (Wet)
Rep. I	1683.3	2099.0	1681.3	1825.0	2015.3	1828.6
Rep. II	1752.3	1890.3	1689.3	1638.3	1730.0	1468.0
Rep. III	1959.0	1951.0	1556.0	1476.0	2132.0	1842.0
Rep. IV	1966.0	1871.6	1871.0	1855.0	2192.3	2206.3
Mean	1840.1	1952.9	1679.8	1698.5	2017.4	1836.2

TABLE 6.—YIELDS IN LBS. PER ACRE.—CHARLOTTETOWN

	A	B	C	D	E (Dry)	F (Wet)
Rep. I	1196.0	1144.3	1190.6	1150.0	1092.3	964.0
Rep. II	839.0	796.6	996.0	1099.0	1153.3	1100.0
Rep. III	1233.3	1276.6	1141.0	966.6	1343.0	1226.3
Rep. IV	1070.6	1141.0	1326.0	1294.6	1416.3	1254.6
Mean	1084.7	1089.6	1163.4	1127.5	1228.0	1136.2

TABLE 7.—MEAN YIELDS IN LBS. PER ACRE TEST AS OBTAINED FROM THE THREE EXPERIMENTAL STATIONS

	Treatments					
	A	B	C	D	E (Dry)	F (Wet)
Yields in lbs. per acre	1652.2	1665.6	1504.2	1601.7	1845.5	1687.1

TABLE 8.—VARIANCE ANALYSIS OF THE FOREGOING DATA

Source of Variance	Sum of squares	Degrees of freedom	Variance	½ log	Z	Fisher's 5% point
1. Differences between districts	2986.94	2	1493.47	3.6543	2.5481	.6008
2. Differences between treatments	144.17	5	28.83	1.6807	.5745	.4668
3. Interaction (Districts) Treatments	61.16	10	6.11	.9049	−.2013	+ Ve. = .3487 — Ve. = .4764
Error	494.07	54	9.14	1.1062		
Total	3686.34	71	51.92			

INTERPRETATION OF TABLES

1. Difference between districts.—Between the districts there is highly significant variance in the total yields as Fisher's 5% point Z value is only .6008 and our calculated Z value is 2.5481. However, this should not be attributed to the treatments, but rather to the difference in suitability of varieties for various Stations and under different climatic conditions for a given year.

2. Difference between treatments.—According to the values obtained there is statistically no advantage gained by any method of treatment. The slightly higher obtained Z value in our experiment is apparently due to the untreated check as borne out in all foregoing tables.

3. Interaction.—Error variance is greater than the interaction variance, therefore, proving to be of no significance. Fisher's 5% point for + Ve. Z value = .3487, and for the –Ve. = .4764. The observed difference is really very moderate and quite insignificant.

Conclusions

Additional data could be given to illustrate that the Wolfryn Electrochemical Process apparently has no beneficial effect on the yield of wheat, but since the actual pounds per acre are the only real index whereby to measure any economic increase, we therefore, refrain from presenting data of comparative insignificance.

While the data are only obtained from one year's results, the fact that at all three widely separated test stations the results are similar leads one to believe that there does not appear to be any advantage in employing this test as a means of increasing the yield of this variety of wheat.

Acknowledgement

For the statistical work involved in the foregoing tables having to do with yields, I am indebted to Mr. F. Gfeller, graduate student in the Cereal Division, Ottawa.

THE ECONOMIC SITUATION

PREPARED IN THE AGRICULTURAL ECONOMICS BRANCH, DEPARTMENT OF AGRICULTURE, OTTAWA, FROM BASIC DATA COLLECTED BY THE DOMINION BUREAU OF STATISTICS

It is frequently necessary to examine not only the short term movement of prices but also the trend over a period of months. Observations of this nature seem to be appropriate at the present time. The index number of wholesale prices receded from 69.4 in August to 68.9 in September. This index was 65.9 in September 1932; in August of last year it was 66.7. The decline in the index number in September of this year was largely due to lower prices in the vegetable products group. Textiles and textile products held even. Wood, wood products and paper advanced. Iron and its products were slightly higher. Non-ferrous metals and their products receded while non-metallic minerals and their products gained substantially. Chemicals and allied products were fractionally above the August level.

Retail Prices.—In the case of retail prices there was a slight advance. The August index was 78.6 whereas that for September was 78.8. Prices of food and clothing advanced whereas rentals were lower.

Physical Volume of Business.—The index number of physical volume of business rose from 89.8 to 90.8. The industrial production index advanced from 89.5 to 90.2. While these advances are below those reported in July and August of this year they do indicate greater business activity than was the case last year at this time when these indexes were consistently in "the seventies". During September the index of mineral production advanced from 98.0 to 108.8. Manufacturing advanced fractionally from 96.9 to 97.0. Construction showed some improvement and the index rose from 25.5 to 26.9. The forestry index declined from 94.0 to 88.0 and iron and steel production fell from 46.4 to 43.5. Agricultural marketings were lower.

Employment.—Employment conditions continued to improve. The number on pay rolls of firms reporting regularly to the Bureau of Statistics at October first was 834,348 as compared with 816,458 at the first of September. The index of employment thus rose to 90.4.

Agricultural Products.—The index number of Canadian farm products fell from 57.0 in August to 54.7 in September. Field products again registered lower prices and the index dropped from 54.9 to 49.5. Weak export demand, offerings of Russian wheat, and favourable reports of crop conditions in Southern Australia and Argentina caused wheat prices to move downward. Prices of barley and oats followed a similar course but flax and rye moved at higher quotations.

The index of animal products advanced from 60.5 to 63.4. This was largely attributed to improvement in prices of fluid milk, eggs and wool; although, on the whole, prices of hogs and claves were somewhat higher. Cattle and lambs were, however, lower.

Considering the longer period it is interesting to note that in September 1932 the index of field rpoducts was 39.5 and that of animal products 60.4. The total index of Canadian farm products in September of last year was 47.3. Carrying the comparison further it is noted that in August 1933 the index of field products was 54.9 whereas in August 1932 it was 42.3. In the case of animal products the index for August 1933 was 60.5 as compared with 58.5 in the same month last year. The total index for August 1932 was 48.4; moreover if we compare the index of July of this year with that of July 1932 it is observed that the indexes of field products were 60.8 and 42.6 respectively, those for animal products 59.0 and 57.8 and the total indexes 60.1 and 48.3.

ANNUAL AND MONTHLY INDEX NUMBERS OF PRICES AND PRODUCTION
COMPUTED BY DOMINION BUREAU OF STATISTICS

Year	Wholesale Prices 1926 = 100				Retail prices and cost of services (5)	Production (6) 1926 = 100			
	All commodities (1)	Farm products (2)	Field products (3)	Animal products (4)		Physical volume of business	Industrial production	Agricultural marketings	Cold Storage holdings
1913....	64.0	62.6	56.4	77.0	65.4	....	....	....	....
1914....	65.5	69.2	64.9	79.0	66.0	....	....	....	....
1915....	70.4	77.7	76.9	79.2	67.3	....	....	....	....
1916....	84.3	89.7	88.4	92.3	72.5	....	....	....	....
1917....	114.3	130.0	134.3	119.6	85.6	....	....	....	....
1918....	127.4	132.9	132.0	134.7	97.4	....	....	....	....
1919....	134.0	145.5	142.4	152.5	107.2	71.3	65.5	48.1	47.1
1920....	155.9	161.6	166.5	149.9	124.2	75.0	69.9	52.6	94.2
1921....	110.0	102.8	100.3	108.5	109.2	66.5	60.4	65.2	86.4
1922....	97.3	86.7	81.3	99.1	100.0	79.1	76.9	82.6	82.6
1923....	98.0	79.8	73.3	95.1	100.0	85.5	83.8	91.4	87.8
1924....	99.4	87.0	82.6	97.2	98.0	84.6	82.4	102.5	114.6
1925....	102.6	100.4	98.1	105.7	99.3	90.9	89.7	97.2	108.9
1926....	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1927....	97.7	102.1	99.9	105.7	98.4	106.1	105.6	103.6	110.0
1928....	96.4	100.7	92.6	114.3	98.9	117.3	117.8	146.7	112.8
1929....	95.6	100.8	93.8	112.5	99.9	125.5	127.4	101.1	109.6
1930....	86.6	82.3	70.0	102.9	99.2	109.5	108.0	103.0	128.4
1931....	72.2	56.3	43.6	77.6	89.6	93.5	90.4	99.0	125.7
1932....	66.7	48.4	41.1	60.7	81.4	78.7	74.0	114.3	120.1
1933									
Jan.....	63.9	43.6	35.1	57.9	79.1	68.1	62.2	56.1	112.0
Feb.....	63.6	43.0	36.0	54.7	78.4	67.0	60.9	76.5	127.6
Mar.....	64.4	44.7	38.0	56.0	77.8	68.4	62.5	129.0	135.8
April...	65.4	46.8	41.1	56.4	78.1	69.8	65.1	104.1	112.7
May....	66.9	51.2	46.9	58.4	77.0	76.4	72.7	95.4	100.4
June....	67.6	52.6	49.4	57.9	77.0	82.2	79.8	221.9	119.9
July....	70.5	60.1	60.8	59.0	77.2	84.1	82.6	136.3	114.5
Aug.....	69.4	57.0	54.9	60.5	78.6	89.8	89.5	197.2	114.2
Sept....	68.9	54.7	49.5	63.4	78.2	90.8	90.2	101.1	115.7

1. See Prices and Price Indexes 1913-1928, pp. 19-21, 270-289 and 1913-1931, p. 15.

2. Wholesale prices of Canadian products of farm origin only. See Prices and Price Indexes 1913-1931, p. 33, and Monthly Mimeographs 1932 and 1933.

3. Wholesale prices of grains, fruits and vegetables.

4. Wholesale prices of Animals and Animal Products.

5. Including foods, rents, fuel, clothing and sundries, See Prices and Price Indexes 1913-1928, pp. 181-185, 290-293. 1926 = 100.

Prices and Price Indexes 1913-1931, pp. 122, and Monthly Mimeographs 1932-1933.

6. Monthly Review of Business Statistics, pp. 8, and Monthly Indexes of the Physical volume of business in Canada, supplement to the Monthly Review of Business Statistics, November, 1932.

The index of agricultural marketings declined from 197.2 in August of this year to 101.1 in September. Reduced movement of grains was the chief factor in the decline, this index falling from 224.6 to 106.2. The index of wheat marketings dropped from 231.9 to 111.8. The movement of oats was considerably higher than in August but the movement of barley was greatly reduced.

Live stock marketings increased. The index for August was 74.5 while in September it rose to 78.0. Fewer cattle moved to market but all other classes of live stock were marketed in increased volume.

The September index of cold storage holdings was slightly above that for August. Increased stocks of eggs, cheese, beef, mutton and lard were reported while supplies of pork, poultry and veal were lower.

Exports.—The summary of the trade of Canada for August (the latest report available) contains interesting figures on exports of Canadian farm products for the twelve months ending August 1933 and for a similar period ending August 1932. When 1932 and 1933 are used in the following discussion the reader will inderstand that reference is to the foregoing periods. Exports of fresh fruits were valued at $7,529,577 in 1932 as compared with $9,110,596 in 1933. Foreign sales of vegetables were $4,253,610 and $3,157,711 respectively. A decline in exports of potatoes from 3,393,915 bushels in 1932 to 1,348,804 bushels in 1933 was largely responsible for the lowe· sales in 1933. Canned vegetables to the value of $854,167 were exported in 1932 whereas only $481,796 worth were shipped abroad in 1933. Foreign markets absorbed 11,798,100 bushels of barley in 1932 against 3,903,013 in 1933. Oats exported amounted to 13,658,810 bushels in 1932 but only 10,512,562 bushels up to the end of August this year. We exported 10,096,251 bushels of rye in 1932 whereas in 1933 we shipped 1,832,075 bushels abroad. Wheat exports in 1932 were 189,184,106 bushels but in 1933 they rose to 230,499,706. Sales of flour to foreign buyers were 5,191,798 barrels in 1932 as against 5,520,519 in 1933. Exports of maple sugar were 3,327,858 pounds in 1932 but fell off to 2,591,084 in 1933. Flax seed shipped to foreign countries amounted to 189,135 bushels in 1932 but 794,391 bushels were exported in 1933. Our export trade in tobacco has been growing in recent years as is evidenced by the fact that in 1932 we exported 10,341,294 pounds while 14,256,920 pounds were shipped in 1933—largely to United Kingdom.

Shipments of cattle to foreign buyers amounted to 52,172 head in 1932 as compared with 41,622 in 1933 although there has been an increase in exports to the United Kingdon. Exports of bacon and hams were 343,087 hundredweights in 1932 and 545,297 hundredweights in 1933. Our exports of canned meats increased from 378,559 pounds in 1932 to 632,237 pounds in 1933. Poultry exports rose from 1,116,182 pounds to 1,304,495 pounds. Cheese exports continue to decline; in the year ending August 1932 we shipped 955,336 hundredweights as against 695,090 hundredweights in 1933. Condensed milk sold abroad in 1932 amounted to 20,245,000 pounds whereas in 1933 we shipped 30,593,500 pounds. Exports of eggs amounted to 441,474 dozens in 1932 and 291,389 dozens in 1933. In 1932 we exported 3,030,523 pounds of honey but only 2,573,467 pounds in 1933. Exports of wool increased from 5,159,582 pounds to 6,775,387 pounds.

In connection with the foregoing statistical information in regard to exports it may be suggested that it is not only necessary to examine the conditions of supply but also to consider foreign purchasing power, trade policies and exchange rates, as well as the nature of competition from countries exporting similar products. These factors frequently change and have at times limited international trade. Export markets have especial significance for Canadian agriculture and, therefore, these problems warrant the closest study.

LA SITUATION ECONOMIQUE

PREPARE PAR LA DIVISION DE L'ECONOMIE AGRICOLE DU MINISTERE DE L'AGRICULTURE, OTTAWA, ET BASE SUR LES DONNEES RECUEILLIES PAR LE BUREAU FEDERAL DE LA STATISTIQUE

Il ne suffit pas de noter les fluctuations quotidiennes ou mensuelles des prix, mais aussi, et surtout, la courbe de ces prix pendant une série de plusieurs mois, et les observations de ce genre paraissent être spécialement indiquées à l'heure actuelle. De 69.4 qu'il était en août l'indice des prix du gros est tombé à 68.9 en septembre. Le chiffre correspondant est de 65.9 pour septembre 1932 et de 66.7 pour août 1932. La diminution notée en septembre de cette année est due principalement à la nouvelle baisse de prix qui s'est produite dans le groupe des produits végétaux. Les matières et les produits textiles ont maintenu leur position; le bois, les produits du bois et le papier ont monté; le fer et ses produits ont légèrement monté; les métaux non ferreux

et leurs produits ont baissé tandis que les minéraux non métalliques et leurs produits ont enregistré une forte hausse. Les produits chimiques et de même nature étaient supérieurs d'une fraction au niveau d'août.

Prix du détail.—Il y a eu également une légère hausse dans les prix du détail. Le chiffre d'août était de 78.6; celui de septembre de 78.8.

Volume physique des affaires.—L'indice du volume physique des affaires s'est élevé de 89.8 à 90.8 et l'indice de la production industrielle, de 89.5 à 90.2. Ces hausses sont inférieures à celles qui ont été notées en juillet et août de cette année, et cependant elles indiquent une activité commerciale certainement plus forte que l'année dernière, alors que les indices ne sortaient pas des "soixante-dix". En septembre l'indice de la production minérale est monté de 98.0 à 108.8; celui de l'industrie manufacturière s'est élevé d'une fraction, de 96.9 à 97.0. Le bâtiment s'est un peu amélioré, passant de 25.5 à 26.9. L'indice des forêts a baissé de 94.0 à 88.0 et la production du fer et de l'acier est tombée de 46.4 à 43.5. L'indice des ventes agricoles a diminué.

Embauchage.—La situation de l'embauchage continue à s'améliorer. Le nombre d'employés salariés sur les listes des maisons qui font régulièrement rapport au Bureau de la Statistique était, au 1er octobre, de 834,348 contre 816,458 au 1er septembre. L'indice de l'embauchage s'est donc élevé à 90.4.

Produits agricoles.—L'indice des produits de ferme canadiens, qui était de 57.0 en août, est tombé à 54.7 en septembre. Les produits des champs ont encore vu leurs prix baisser et l'indice est tombé de 54.9 à 49.5. La faible demande d'exportation du blé, l'offre de blé russe et les rapports favorables de l'état de la récolte dans le Sud de l'Australie et l'Argentine ont encore fait baisser les prix du blé. Les prix de l'orge et de l'avoine ont suivi le même cours, mais ceux du lin et du seigle se sont relevés.

L'indice des prix des produits animaux est passé de 60.5 à 63.4, principalement à cause de l'amélioration qui s'est produit dans les prix du lait en nature, des oeufs et de la laine; en général, les prix des porcs et des veaux étaient un peu plus élevés mais les prix des boeufs et des agneaux étaient plus bas.

Quelques faits intéressants se dégagent des comparaisons à long terme:—en septembre 1932 l'indice des produits des champs était de 39.5 et celui des produits animaux de 60.4. En septembre de l'année dernière, l'indice total des produits de ferme canadiens était de 47.3. Si l'on porte la comparaison un peu plus loin on voit qu'en août 1933 l'indice des produits des champs était de 54.9 tandis qu'il était de 42.3 en août 1932. En ce qui concerne les produits animaux l'indice d'août 1933 était de 60.5 contre 58.5 en août 1932. L'indice total pour août 1932 était de 48.4; en outre, si l'on compare l'indice de juillet de cette année à celui de juillet 1932 on voit que les indices des produits des champs étaient de 60.8 et 42.6 respectivement, ceux des produits animaux de 59.0 et 57.8, et les indices totaux de 60.1 et 48.3.

L'indice des ventes agricoles, qui était de 197.2 en août de cette année est tombé à 101.1 en septembre. La diminution des expéditions du grain était la cause principale de cette baisse; l'indice est tombé de 224.6 à 106.2. L'indice des ventes de blé est tombé de 231.9 à 111.8. Il s'est transporté beaucoup plus d'avoine qu'en août mais beaucoup moins d'orge.

Les ventes de bétail ont augmenté. L'indice pour août, qui était de 74.5, a passé à 78.0 en septembre. Il s'est transporté moins de bovins au marché mais plus d'animaux de toutes les autres catégories de bestiaux.

L'indice des produits conservés au froid en septembre était un peu supérieur à celui d'août. On signalait des stocks plus considérables d'oeufs, de fromage, de boeuf, de mouton et de saindoux, mais des approvisionnements plus restreints de lard, de volailles et de veau.

Exportations.—Le résumé du commerce du Canada en août (le dernier rapport paru) contient des chiffres intéressants sur les exportations de produits de ferme

canadiens pendant les douze mois finissant en août 1933 et pendant une période semblable finissant en août 1932. Lorsque nous employons les chiffres de 1932 et 1933 dans la discussion qui suit, il faut bien comprendre que nous nous rapportons aux périodes précédentes. Les exportations de fruits frais étaient évaluées à $7,529,577 en 1932 contre $9,110,596 en 1933. Les ventes de légumes à l'étranger étaient de $4,253,610 et $3,157,711 respectivement. La diminution dans les exportations de pommes de terre, qui de 3,393,915 boisseaux qu'elles étaient en 1932 sont tombées à 1,348,804 boisseaux en 1933, est la cause principale de la diminution des ventes en 1933. Il s'est exporté en 1932 des légumes en conserves pour une valeur de $854,167 tandis qu'il ne s'en est expédié que pour $481,796 en 1933. Les marchés étrangers ont absorbé 11,798,100 boisseaux d'orge en 1932 contre 3,903,013 en 1933. Les exportations d'avoine ont atteint le chiffre de 13,658,810 boisseaux en 1932; en 1933, à la fin du mois d'août, la quantité exportée n'était que de 10,512,562 boisseaux. Nous avons exporté 10,096,251 boisseaux de seigle en 1932 contre 1,832,075 boisseaux en 1933. En 1932 les exportations de blé se montaient à 189,184,106 boisseaux; en 1933 elles se se sont élevées à 230,499,706. Les ventes de farine aux acheteurs étrangers avaient été de 5,191,798 barils en 1932 contre 5,520,519 en 1933. Les exportations de sucre d'érable, qui étaient de 3,327,858 livres en 1932, sont tombées à 2,591,084 en 1933. La graine de lin expédiée aux pays étrangers se montait à 189,135 boisseaux en 1932, mais en 1933 il s'en est exporté 794,391 boisseaux. Notre commerce d'exportation de tabac a grandi en ces dernières années; en 1932 nous en avons exporté 10,341,294 livres et en 1933 14,256,920 livres, principalement au Royaume-Uni.

La quantité de boeufs expédiés aux acheteurs étrangers, qui se montait à 52,172 têtes en 1932, est tombée à 41,622 têtes en 1933, quoique les exportations sur le Royaume-Uni aient augmenté. Les exportations de bacon et de jambon se montaient à 343,087 quintaux en 1932 et à 545,297 quintaux en 1933. Nos exportations de viandes en conserves ont passé de 378,559 livres en 1932 à 632,237 livres en 1933. Les exportations de volailles, qui étaient de 1,116,182 livres se sont élevées à 1,304,495 livres. Les exportations de fromage baissent toujours; au cours de l'année finissant en août 1932 nous avons expédié 955,336 quintaux contre 695,090 quintaux en 1933. La quantité de lait condensé vendu à l'étranger en 1932 se chiffrait par 20,245,000 livres tandis qu'en 1933 nous en avons expédié 30,593,500 livres. Les exportations d'oeufs se montaient à 441,474 douzaines en 1932 et à 291,389 douzaines en 1933. En 1932 nous avons exporté 3,030,523 livres de miel et en 1933 seulement 2,573,467 livres. Les exportations de laine ont passé de 5,159,582 livres à 6,775,387 livres.

En ce qui concerne les renseignements statistiques qui précèdent sur les exportations, nous croyons utile de dire qu'il ne suffit pas d'examiner la situation de l'offre mais aussi le pouvoir d'achat à l'étranger, les régimes commerciaux et le taux du change, ainsi que la nature de la concurrence que nous font les pays exportant les mêmes produits. Ces facteurs varient souvent et ils apportent parfois des entraves au commerce international. Les débouchés d'exportation offrent une importance toute spéciale pour l'agriculture canadienne, et c'est pourquoi ces problèmes méritent d'être étudiés avec le plus grand soin.

RESUME DES ARTICLES PUBLIES EN ANGLAIS DANS CE NUMERO

Impressions de la East Malling Research Station. R. C. Palmer, Ferme expérimentale fédérale, Summerland, Colombie britannique.

L'organisation de la East Malling Research Station, Angleterre, est décrite et on discute le résultat de quelques-unes de ses recherches. Les hommes de science dans bien des sphères ont cooperé afin d'obtenir des résultats d'une valeur pratique aux éleveurs de fruits. On insiste sur la valeur du travail de recherche fondamental, particulièrement lorsque des hommes s'occupant de différentes sciences peuvent

travailler sous un même directeur et sur le même matériel, le considérant sous ses différents aspects.

La Fletrissure de L'Aubergine. J. K. Richardson, Laboratoire fédéral de pathologie végétale, St. Catharines, Ont.

Il a été nettement établi que le *Verticillium Dahliae* Kleb est responsable de la flétrissure de l'aubergine. Cet organisme produit la flétrissure typique lorsque la température du sol est entre 11°C et 30°C. Il ne la produit plus à 35°C. L'application de divers engrais ne contrôle pas la maladie. L'addition au sol d'une solution de chlorure mercurique avant le repiquage des plants, suive d'applications subséquentes, a contrôlé la maladie en serre, et l'a considérablement retardée en culture à l'air libre.

On recommande les mesures de contrôle suivantes. Obtenir la graine de producteurs n'ayant pas la maladie sur leur terre. Stériliser la semence avant de la planter. Garder les plants en sol stérilisé depuis les semailles jusqu'au repiquage à l'air libre. Ne pas planter d'aubergines pendant plusieurs années à la suite de récoltes susceptibles au *Verticillium* telles que les framboises, les tomates, les pommes de terre, etc. Planter les aubergines de préférence après une céréale, une plante fourragère, ou un engrais vert. Enlever et brûler avant le labour tous les restes de plantes attaquées par le *Verticillium*, aussi bien tomates et pommes de terres qu'aubergines; l'enfouissement d'une récolte malade augmente la quantité d'éléments pathogènes dans le sol. Ne pas jeter de plantes malades sur le tas de fumier ou de compost: c'est la méthode idéale pour contaminer toute une exploitation. Eviter autant que possible de transporter du sol de régions atteintes dans les régions où la maladie n'a pas encore fait son apparation.

Electrolyse de la graine de cereales. J. G. C. Fraser et L. M. Pidgeon, Ferme expérimentale centrale, et laboratoire de Recherches national, Ottawa.

Le blé de semence Huron, fut traité aux laboratoires de Recherches national, Ottawa, par le procédé Wolfryn Electro-Chemical, et ensemencé à Charlottetown, Fredericton et Ottawa. Les résultats de cet essai démontrent qu'il ne semble y avoir aucun avantage à employer cette méthode dans le but d'augmenter le rendement du blé Huron.

La Valeur Antirachitique de l'Huile de Sardine dans l'Elevage des Poussins. Jacob Biely et V. Elvira Palmer, Université de Columbie brittanique, Vancouver, Canada.

Les résultats obtenus dans ces expériences confirment ceux obtenus par d'autres expérimentateurs, à savoir que l'huile de sardine est égale à l'huile de foie de morue médicale ou commerciale pour la production d'un système osseux normal. Les poussins recevant ½% d'huile de sardine ont montré une croissance normale et un développement osseux comparable à celui des poussins recevant 1% d'huile de foie de morue. Ces expériences montrent que l'huile de sardine ordinaire du commerce est aussi riche en vitamine D que l'huile de sardine raffinée. Il est aussi évident que l'huile de sardine ne se détériore pas après être conservée pendant un an dans des conditions convenables.

Etude sur les Qualites de Brasserie de l'Orge. T. J. Harrison, Bureau des Commissaires des Grains du Canada, Winnipeg, Man.

L'étude de l'effet de la situation géographique sur la qualité de l'orge de brasserie montre que pour le Canada l'Ile du Prince Edouard devrait être à même de produire la meilleure orge de brasserie et que les autres Provinces de l'Est pourraient produire une qualité satisfaisante. En Colombie britannique la qualité varie suivant le sol et les conditions climatériques des diverses vallées. Dans les Prairies c'est le Manitoba qui produit la meilleure qualité, bien qu'une qualité satisfaisante puisse être obtenue dans les parties septentrionales de l'Alberta et de la Saskatchewan. Dans le Manitoba ce sont l'est et le nord qui donnent les meilleurs résultats.

Si l'on considère les variétés d'orge en relation avec les méthodes de brasserie utilisées au Canada, c'est le groupe des orges à six rangs d'origine mandchoue qui donne les meilleurs résultats. Dans ce groupe c'est O.A.C. No. 21 et la Chinoise qui donnent les meilleurs rendements. L'orge de juillet aurait une place si elle était produit en quantité. On ne peut en effet la mélanger à l'O.A.C. No. 21 ni la Chinoise. Le groupe méditérranéen ne se montre pas satisfaisant bien qu'il comprenne des variétés californiennes aussi renommées que Bay-Brewing, Mariout, etc. Parmi les variétés à deux rangs le groupe Chevalier est nettement supérieur au groupe Duckbill. Dans ce groupe les meilleures variétés sont Hannchen et Plumage Archer. Avec les méthodes de fabrication du malt en usage dans le Royaume Uni ce sont les mêmes variétés qui donnent les meilleurs résultats, a savoir, Hannchen et Plumage Archer parmi les variétés a deux rangs, et O.A.C. No. 21 et Chinoise parmi les variétés à six rangs.

Joseph Jean Robert Marcotte

1901 - 1933

Joseph Jean Robert Marcotte, né à Ste Anne de la Pérade (comté de Champlain) le 27 décembre 1901, du mariage du Dr. François Arthur Marcotte, M.D. ex-député de Champlain à la Chambre des Communes et de Dame Alma Marie La Rue; fit ses études primaires à Ste-Anne de la Pérade (Collège du Sacré-Coeur) jusqu'à 1913, puis au Séminaire des Trois-Rivières et au Collège de Lévis pour ses études classiques; de là, il se dirigea vers l'Institut Agricole d'Oka, (1920-24) d'où il est sorti après un stage de quatre années avec le titre de B.S.A.

Ses professeurs et confrères ont gardé un souvenir inoubliable de Robert Marcotte. Son goût prononcé pour les sciences, aidé d'une intelligence de grande envergure l'ont conduit dans les premiers de sa classe. Ses grandes qualités morales, sa bonne humeur, sa gaité, même aux heures tristes de la vie le faisaient rechercher par ses confrères et ses amis.

Au sortir de l'Université, il fit quelques voyages d'étude, entre autres dans l'Ouest Canadien, aux Etats-Unis et après quoi, il assuma la charge de diriger la ferme de son père, médecin, qui n'avait pas trop de temps pour s'occuper de ses malades; il y réussit à merveille.

Après quelques années, c'est-à-dire en 1930, désireux de communiquer à la classe agricole les connaissances acquises dans l'étude et le travail, il entre au Département de la Division Fédérale d el'Industrie Animale et depuis lors, notre ami ne se souciait des fatigues du travail ardu qu'il avait à remplir; il fut un apôtre chez les agriculteurs. Là aussi, sut-il capter la confiance et l'estime de tous et en particulier de ses chefs.

Jeune encore, il souriait à la vie, cette vie prometteuse de succès, de gloire et d'honneur. Mais les vues mystérieuses et profondes de la Providence échappent à notre compréhension humaine. Agà de 31 ans et 9 mois, après trois semaines de maladie, le 24 septembre 1933, l'âme de notre cher confrère s'envolait vers les régions heureuses de l'Au-Delà.

Sur cette tombe à peine fermée aux misères et aux souffrances terrestres, mais entr'ouverte déjà aux joies béatifiques, je dépose une gerbe de profondes sympathies et l'assurance d'un pieux et durable souvenir.

Un confrère de travail,

ALBERT DESROSIERS,
Nicolet.

ANNUAL MEETING OF THE CANADIAN SEED GROWERS' ASSOCIATION

The Canadian Seed Growers' Association held its annual meeting at Regina, Sask., on July 21 and 22, 1933. The various sessions were more than usually well attended by farmer grower members, and an increasing enthusiasm was manifest on the part of growers in the work of the Association.

A comprehensive account of this meeting will be contained in the C.S.G.A. Annual Report. This report contains (*a*) a summary of the proceedings of the business sessions. (*b*) Board of Directors' Report for 1932-33, (*c*) report of the Treasurer for 1932-33, (*d*) reports of C.S.G.A. standing committees, (*e*) reports of plant breeders' committees, (*f*) reports of C.S.G.A. provincial directors and local branch secretaries and (*g*) the ever popular "Growers' Corner" which contains notes and news of interest to C.S.G.A. growers. Any C.S.T.A. member desiring a copy of this Annual Report may receive one on request to W. T. G. Wiener, Secretary, Canadian Seed Growers' Association, 336 Jackson Building, Ottawa, Ont.

To give recognition to grower members who have distinguished themselves in the service of the C.S.G.A., the Association awards Robertson Assoicate memberships. The name "Robertson Associates" was given to this preferred class of membership in honour of the founder of the Association, the late Dr. J. W. Robertson, LL.D., C.M.G., who was a Charter Member and Fellow of the C.S.T.A. Two C.S.G.A. Robertson Associates were elected this year, namely, Dr. C. A. Zavitz, Ilderton, Ont., and Mr. A. C. B. Grenville, Morrin, Alta. The former is well known to C.S.T.A. members being a Charter Member and a Fellow of the Society, and the latter is a veteran seed grower who has also done yeoman service to Canadian agriculture.

Mr. A. L. Searle, President of the Searle Grain Co., Limited, was presented with the first Honorary Membership ever awarded by the Canadian Seed Growers' Association. The certificate of honorary membership, which was presented to Mr. Searle by the President on behalf of the Association, took the form of a beautifully prepared parchment inscribed with the declaration that "Mr. A. L. Searle has been elected an Honorary Member of the Canadian Seed Growers' Association in recognition of his sympathetic support of crop improvement and his interest in the activities of the Association."

Professor T. J. Harrison retired from the Presidency of the Association, a post he has held for four years. Professor R. Summerby was unanimously elected President for the ensuing year and took over his new duties upon the last day of the official sessions.

The officers of the C.S.G.A. for 1933-34 are:

Honorary President: George H. Clark, Dominion Seed Commissioner, Ottawa, Ont.

Honorary Vice-Presidents: C. A. Zavitz, Ilderton, Ont.; H. G. L. Strange, Searle Grain Co., Ltd., Winnipeg, Man.; L. H. Newman, Dominion Cerealist, Ottawa, Ont.; T. J. Harrison, Dominion Board of Grain Commissioners, Winnipeg, Man.

President: Robert Summerby, Macdonald College, P.Q.

Vice-President: F. W. Townley-Smith, Lashburn, Sask.

Secretary-Treasurer: W. T. G. Wiener, 336 Jackson Building, Ottawa, Ont.

ANNUAL MEETING OF THE CANADIAN PHYTOPATHOLOGICAL SOCIETY

The Canadian Phytopathological Society held its Third Annual Meeting in Regina, Sask., July 25 to 28, 1933, in conjunction with the Annual Meeting of the Canadian Society of Technical Agriculturists and the World's Grain Exhibition and Conference. The meeting was well attended by the Western members of the Society.

The sessions were held in Regina College. Twenty papers were read before the Society and evoked considerable discussion. These papers were chiefly in the field of Cereal Pathology. Two joint sessions were held when the plant pathologists joined with the agronomists. About one half of these papers were of particular interest to the pathologist. Many of the scientific papers read before the World's Grain Conference were also greatly appreciated by members of the Society. The exhibits at the World's Grain Exhibition were a great credit to the management, the plant Pathological exhibit prepared by the Division of Botany being one of the best ever assembled. The exhibit of living plants graphically illustrating how the inheritance of disease resistance in two or more plants may be combined into a single plant, was particularly good.

A successful business session was held under the chairmanship of Prof. W. P. Fraser, President of the Society. Mr. N. A. MacRae, Assistant Secretary-Treasurer read the minutes in the absence of Mr. T. J. Major, retiring Secretary-Treasurer. M. Etienne Foëx, Versailles, France, was elected an honorary member. Reports of committees were read and approved. Dr. P. M. Simmonds, Chairman of the local committee was especially commended for the excellent arrangements. As the result of a mail ballot conducted in May, the following executive was elected:

President: D. L. Bailey, University of Toronto.

Vice-President: J. H. Craigie, Dominion Rust Research Laboratory, Winnipeg.

Secretary-Treasurer: I. L. Conners, Central Experimental Farm, Ottawa.

Councellors: J. G. Coulson, Macdonald College, P.Q.; W. P. Fraser (ex-officer), University of Saskatchewan, Saskatoon; H. T. Güssow, Central Experimental Farm, Ottawa.

ANNUAL MEETING OF THE WESTERN CANADIAN SOCIETY OF AGRONOMY

The annual business session of the Western Canadian Society of Agronony was held at Regina College on July 28th. From the point of view of the Society, the connection with the World's Grain Exhibition and Conference was very valuable, and interest and attendance exceeded expectations.

Two reports were received from the standing committees. These included a report of the Farm Machinery Committee by Prof. E. A. Hardy of the University of Saskatchewan, and a report of the Cereal Zonation Committee by Dr. J. B. Harrington, also of the University of Saskatchewan. These papers were very interesting and were a continuation of the work of these standing committees which have been operating for the past three years. The matter of the Society disseminating information, in the way of popular articles, was discussed to some extent and the incoming Executive were instructed to approach a number of the members with a view to having them prepare such articles during the coming year. It was felt that a number of projects were being carried out by the Society, and the information obtained from these should be made available.

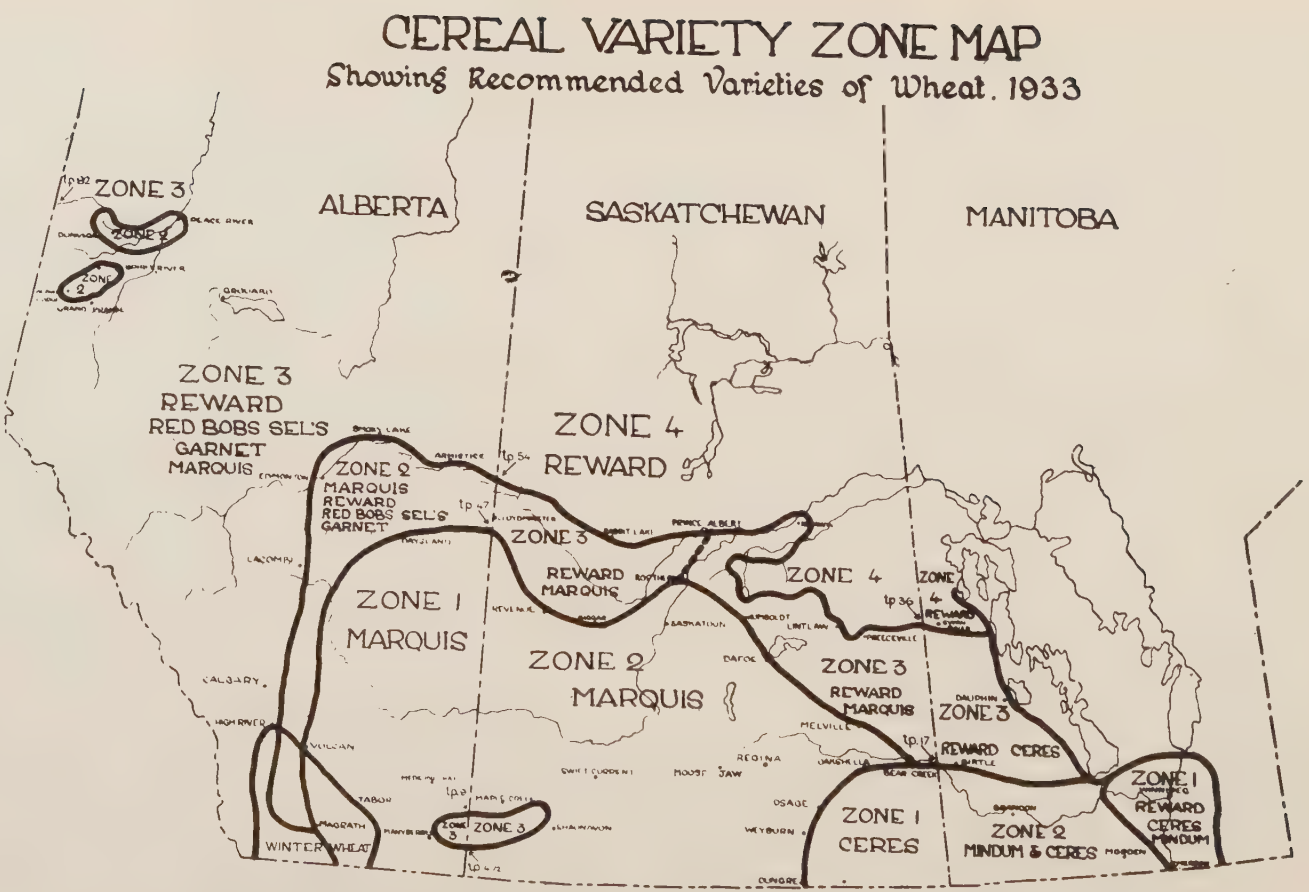
Arrangements for the 1934 Annual Meeting were left to the incoming Executive. The following officers were elected for next year:

President: Dr. O. S. Aamodt, University of Alberta, Edmonton, Alta.

Vice-President: Dr. J. B. Harrington, University of Saskatchewan, Saskatoon, Sask.

Secretary: G. E. DeLong, Dominion Experimental Farm, Lacombe, Alta.

Directors: D. A. Brown, Dominion Experimental Farm, Brandon, Manitoba; Dr. J. R. Fryer, University of Alberta, Edmonton, Alberta.



Cereal Variety Zone Map, prepared by the Western Canadian Society of Agronomy Committee in the Co-ordination of Cereal Variety Zones in Western Canada.

Report of the Committee on the Co-ordination of Cereal Variety Zones in Western Canada

The 1932 report of this committee was made at the annual meeting of the Western Canadian Society of Agronomy at Winnipeg in June, 1932, and included a resumé of the establishment of cereal variety zonation in Western Canada. It was published in *Scientific Agriculture* in Volume XIII, Number 7, March, 1933. The zone map, accompanying that report, showed full co-ordination of the existing zone lines but revealed and emphasized the need for a uniform system of zone designations and for a northern forest zone in Saskatchewan, corresponding with the forest zones of the adjacent provinces.

The Cereal Variety Committee of Saskatchewan had recognized the need of a division of Zone A (north and north-east park belt and forest area) into two zones but felt that action should be delayed until completion of the soil survey of that region would enable accurate placing of the new zone line. Last February a fairly complete soil survey map was available for the use of the Saskatchewan cerealists and the desired division of Saskatchewan Zone A into dark soil park belt and bush country was made. Furthermore, the Saskatchewan zone designations were changed to Arabic numerals to conform to those used in Alberta and Manitoba, i.e. 1, 2, 3 and 4 instead of B, C and A. The Saskatchewan cerealists left the precise termination of the new zone boundaries to the Zone Co-ordination Committee to be adjusted fairly with the zone boundaries of Manitoba and Alberta. Due to the excellent co-operation of the Manitoba and Alberta Cereal Committees, the zone boundary co-ordination was easily effected. As for varietal recommendations, the Co-ordination Committee feels that they are remarkably consistent from province to province, according to the conditions found in the different zones. This is particularly true with respect to wheat, the most important crop.

The present zone boundaries of the three Prairie Provinces are shown in the accompanying outline map, together with the names of the wheat varieties recommended in each zone. After the establishment of the new zone line in Saskatchewan, separating zones 3 and 4, it was necessary to move the eastern termination of the line between Alberta zones 2 and 3 and the western termination of the line between Manitoba zones 3 and 4, each slightly to the north, in order that satisfactory link-ups could be made between those lines and the ends of the new Saskatchewan line.

The personnel of the Zonation Committee is as follows: Dr. O. S. Aamodt, University of Alberta, Edmonton; Mr. J. G. Davidson, Dominion Experimental Farm, Indian Head, Saskatchewan, Prof. A. T. Elders, University of Manitoba, Winnipeg; Dr. C. H. Goulden, Dominion Rust Research Laboratory, Winnipeg, Manitoba; Mr. W. D. Hays, Dominion Experimental Farm, Lethbridge, Alberta; Dr. J. B. Harrington (Chairman), University of Saskatchewan, Saskatoon.

After two years of operation, The Varietal Zonation Committee of the Western Canadian Society of Agronomy feels that the lightness and success of its work is due chiefly to the excellent spirit of co-operation existing in and among the three provincial cereal committees.

J. B. Harrington, *Chairman.*

ANNUAL MEETING OF THE CANADIAN SOCIETY OF AGRICULTURAL ECONOMICS

The annual business session of the Canadian Society of Agricultural Economics was held in Regina College on July 26th in connection with the World's Grain Exhibition and Conference. In view of the fact that the morning sessions of the Grain Conference were largely economic in nature, a heavy programme was not planned for the technical sessions of the Society. The following resolution was passed at the business session.

"That this Society wishes to go on record emphasizing the need for the establishment of an Agricultural Outlook Service in Canada as previously placed before this organization. We commend the report of the Select Committee on Economics, Marketing and Agricultural Outlook given at the recent Conference called by the Federal Minister of Agriculture and particularly stress the place therein given to the Agricultural Outlook. We also wish to commend the work already accomplished on this project in the Provinces of Saskatchewan and Nova Scotia and the plan followed by these Provinces in the co-ordination of this work in these Provinces."

The officers and executive of the Society for 1933-34 are as follows:

President: J. F. Booth, Department of Agriculture, Ottawa, Ont.

Vice-President: H. C. Bois, Department of Agriculture, Quebec, P.Q.

Secretary: J. Coke, Department of Agriculture, Ottawa, Ont.

Executive: T. W. Grindley, Bureau of Statistics, Ottawa, Ont.; H. R. Hare, Vancouver, B.C. (4378 W. 13th St.); W. Allen, University of Saskatchewan, Saskatoon; F. W. Reinoehl, Colonization Finance Corporation of Canada Ltd., Winnipeg, Man.

ANNUAL MEETING OF THE CANADIAN SOCIETY OF ANIMAL PRODUCTION, WESTERN SECTION

The Sixth Annual General Meeting of the Western Canada Society of Animal Production was held on July 31, August 1, 2 and 3, in Regina, during the World's Grain Exhibition and Conference. Meetings were held in the Armories adjoining the Fair Grounds. The meetings were well attended and much discussion took place on the various papers presented.

The minutes of the 1931 meeting at Saskatoon were reviewed and resolutions read in full. Due to present conditions it was not possible to give any favourable report on the resolutions. The minutes were adopted as printed.

The first order of business was the ratifying of the Constitution of the Canadian Society of Animal Production. This was read to the meeting and the following resolution was moved by Dr. Bowstead and seconded by Dean Shaw:

"Whereas the Western and Eastern Societies of Animal Production have approved of the amalgamation to form the Canadian Society of Animal Production and the Eastern Canada Society has approved of the Constitution, therefore be it resolved that this Society also approves of the Constitution as read and that the Eastern Canada Society be notified of the same."

The meeting then carried on as the Western Section of the Canadian Society of Animal Production.

The following are the officers and directors for 1933-34:

President: G. W. Wood, Manitoba Agricultural College, Winnipeg, Man.

Vice-President: C. M. Learmonth, Department of Agriculture, Regina, Sask.

Secretary-Treasurer: R. M. Hopper, Dominion Experimental Farm, Brandon, Man.

Directors for Provinces: British Columbia—H. Hicks, Dominion Experimental Farm, Agassiz, B.C.; Alberta—L. B. Thomson, Dominion Range Experiment Station, Manyberries, Alta.; Saskatchewan—Dean A. M. Shaw, University of Saskatchewan, Saskatoon, Sask.; Manitoba—J. Bell, Livestock Commissioner, Department of Agriculture, Winnipeg, Man.

ANNUAL MEETING OF THE HORTICULTURAL GROUP OF THE C.S.T.A.

The activities of the Horticultural Group this year were somewhat curtailed owing to there being so few of the members of this group at the World's Grain Show. The absence of the members was not, however, due to lack of interest in the organi-

zation, but largely due to economic conditions. As evidence that interest in this group has not waned, it should be pointed out that a number of reports promised for presentation were in the hands of the chairman. These included a resumé of the activities of the marketing committee by H. J. M. Fiske, Mutual Brokers, Ottawa, Ontario; Report of Committee on Varieties of Fruit, E. F. Palmer, Director, Horticultural Experiment Station, Vineland, Ontario; and the Report of the Committee on History of Horticulture, R. P. Gorham, Entomological Laboratory, Fredericton, N.B.

To facilitate hearing Sir Daniel Hall, Director, John Innes Horticultural Institute, London, England, the reading of the minutes of the 1932 meeting, as well as the reading of the above reports was dispensed with owing to the very limited time available.

The chief item of interest was a very fine address by Sir Daniel Hall, dealing with the behaviour of diploid and triploid plants and the application of this knowledge to plant breeding. Following the address a number of slides were used to illustrate the various points of interest mentioned in the previous part of the address.

The appreciation of the members was extended to Sir Daniel Hall by Mr. W. R. Leslie, acting chairman.

ANNUAL MEETING OF SOILS GROUP OF THE C.S.T.A.

A departure from the programme arrangement of the prevoius year was that the business sessions were held apart from the technical sessions. The business meetings, held at Regina College, on Wednesday and Thursday mornings, July 26th and 27th, were devoted to discussion of the affairs of the Soils Group and to the presentation and discussion of the reports of the various committees appointed at the previous convention.

Due to the absence of the chairman of the Group, Professor G. N. Ruhnke, the vice-chairman, Professor A. H. Joel occupied the chair, with Prof. A. Leahey as secretary.

Decisions of the meeting affecting the activities and policy of the Soils Group were:

1. To remain as a Soils Group within the C.S.T.A. rather than set up an independent organization. This decision prevents the inclusion of non-members of the C.S.T.A. in this section unless the consent of the parent organization is obtained.

2. Revision of the list of soil workers and their activities, this work to be done by the secretary with the aid of corresponding secretaries appointed by the executive, one for each province.

3. That a committee be appointed by the executive to report on the laboratory methods used by the various colleges and institutions in Canada.

4. That the chairman and secretary of the Group be selected from the district where the next convention is to be held.

No action was taken with regard to the question of affiliation with other soil organizations. Professor J. H. Ellis urged that members of the Group on their own accord should become affiliated with the Imperial Bureau of Soils.

The report of the Committee on Research and Experimental Projects in Soils prepared by Professor G. N. Ruhnke was presented by A. H. Joel. The work of this committee, although well advanced, is not yet completed. The meeting decided to ask Professor Ruhnke to carry on this work to completion and urged that members of the Group give him their fullest co-operation.

The report of the Genetic Soil Map Committee was presented by Professor A. H. Joel. A very interesting map showing the genetic classification of the soils in Canada was the main feature of this report. Steps are being taken to make this map available to the various interested institutions.

The following executive was elected for the coming year:

Chairman: Dr. E. S. Hopkins, Central Experimental Farm, Ottawa, Ont.

Vice-chairman: Dr. A. Leahey, University of Alberta, Edmonton, Alta.

Secretary: Dr. R. R. McKibbon, Macdonald College, P.Q.

Report of the Chairman of the Genetic Soil Map Committee

At a meeting of the Soils Group at the Winnipeg Convention, 1932, the writer presented a paper entitled, "The Preparation of a Genetic Soil Map of Canada." The paper was published in *Scientific Agriculture* in the issue of October, 1932. Following the discussion of the paper, the group requested the writer to appoint a committee to work on the project and to act as chairman of such a committee. The following committee was appointed:

Dr. D. G. Laird for British Columbia.
Mr. C. C. Kelley for British Columbia.
Dr. F. A. Wyatt for Alberta.
Prof. A. H. Joel for Saskatchewan.
Prof. J. H. Ellis for Manitoba.
Mr. F. F. Morwick for Ontario.
Dr. R. R. McKibbon for Quebec.
Prof. Auguste Scott for Quebec.
Prof. L. C. Harlow for Nova Scotia.
Mr. E. M. Taylor for New Brunswick.
Dr. J. A. Clark for Prince Edward Island.
Dr. E. S. Hopkins for the Central Experimental Farm, Ottawa.

The Committee has worked actively during the year and has produced the first tentative general soil map of Canada. The necessary information was submitted by the various members of the committee and the map was prepared by the chairman.

The map was presented at a Soils Group Meeting at Regina Conference. The soils of British Columbia were discussed by Dr. D. G. Laird, those of Alberta by Dr. F. A. Wyatt, those of Saskatchewan by Prof. A. H. Joel, and those of Manitoba by Prof. J. H. Ellis. As the other committee members were not present, soils of the remaining provinces were discussed by Prof. A. H. Joel, the discussion being based on information previously submitted by the representatives of these provinces. The reception of the map was very encouraging and the discussion of the soils of the various provinces most stimulating. It became evident that the map would be very useful in the future in connection with the discussion of soil problems in various parts of Canada.

It was recommended at this meeting that the committee continue its work, particularly to revise and add to information already collected.

The chairman offered to circulate a copy of the map among the committee members during the coming year for copying, in order that at least one map would be available in each province. As soon as some necessary additions and revisions are made on this original map, this will be done. A copy of descriptions of the various soil groups will also be sent with the map.

A. H. Joel, *Chairman.*

ANNUAL MEETING OF THE ENGINEERING GROUP OF THE C.S.T.A.

The second annual conference of the Agricultural Engineering Group of the C.S.T.A. held at Regina College during the World's Grain Exhibition and Conference was a decided success. Though the programme was a very heavy one every paper was presented. At several of the sessions of this group the attendance ran between forty and fifty. This group also constituted itself as the Canadian Section of the American Society of Agricultural Engineers, of which society most of the group are members, the same executive serving both organizations.

So far as the interests of this group are concerned, the World's Grain Conference performed an inestimable service in bringing together farmers, college professors and research men, and engineers from the farm implement firms. There are many problems in Agricultural Engineering, and indeed in agriculture generally which can best be solved by the united efforts of men from these three specialties. It is to be hoped that this conference will prove to be merely the first of many such gatherings.

Agricultural Engineering was given a prominent place when the Grain Conference Programme Committee invited Mr. E. J. Stirniman, Consulting Agricultural Engineer of Brooklyn, Iowa, to open the conference sessions on the evening of July 24th with a paper on "The Mechanization of Agriculture in Russia." During the group sessions twenty-four papers were read on various economic and technical problems of mechanization.

The following are executive officers of the Agricultural Engineering Group of the C.S.T.A. for 1933-34:

Chairman: F. L. Ferguson, Ontario Agricultural College, Guelph, Ont.

Vice-Chairman: E. A. Hardy, University of Saskatchewan, Saskatoon, Sask.

Secretary: L. G. Heimpel, Macdonald College, P.Q.

ENTOMOLOGICAL SESSIONS WORLD'S GRAIN EXHIBITION AND CONFERECNE

The entomological sessions of the World's Grain Conference were organized by the chairman of the Entomological Programme Committee, Mr. Arthur Gibson, Dominion Entomologist.

The activities involved four public conference meetings and two business meetings of the International Great Plains Conference of Entomologists, the latter group meeting with and forming an integral part of the conference.

The programme included twenty-three authoritative invitation papers upon the most significant grain pests, the list embracing grasshoppers, wireworms, pale western cutworm, Hessian fly, chinch bug, European corn borer, wheat stem sawfly, hairy spider beetle, "Insects Injurious to Rice in Siam" and "Pests of the Wheat Crop in India."

The several sessions were carried on under a rotation of chairmanships including Mr. Arthur Gibson, Entomological Branch, Ottawa, Canada; Dr. W. H. Larrimer, Bureau of Entomology, Washington, United States of America; Prof. E. H. Strickland, University of Alberta, Edmonton, Alberta and Prof. A. G. Ruggles, University of Minnesota, St. Paul, Minnesota, United States of America, who also presided over the business sessions of the associated group.

The International Great Plains Entomologist's Conference is a rather loosely organized group of prairie entomologists who meet annually. Prof. A. G. Ruggles was elected chairman for 1934, the next meeting to be in Minnesota, U.S.A., at the time and place selected by the chairman.

The conference was of the greatest inspiration and value, particularly to the Canadian participants. It occurred in a year of a period of great insect activity when the most aggressive application of control measures over very wide areas was necesasry to the prevention of the loss of literally millions of bushels of wheat and other grain. Under these circumstances the review in conference by leaders in grain pest control work through formal address and discussion had a very definite and direct application to the solution of pressing Canadian problems. Such applications have since been made upon many hundreds of thousands of acres of prairie land in protection of Canadian crops.

The Canadian entomologists especially, therefore, recognize that they rest under a deep obligation to the World's Grain Exhibition and Conference for providing the opportunity to hold such a conference at such an auspicious moment.

W. F. GEDDES HEADS GRAIN RESEARCH LABORATORY

The appointment of Dr. W. F. Geddes to head the Grain Research Laboratory of the Board of Grain Commissioners at Winnipeg has been announced. Dr. Geddes, one of the leading cereal chemists on the North American Continent, has been Professor of Agricultural Chemistry at the University of Manitoba since 1925. As

Secretary of the Associate Committee on Grain Research of the National Research Council, he has been in close touch with all cereal research work conducted in Canada. Many of his own researches have been published in *Cereal Chemistry* and the *Canadian Journal of Research.*

During the past few months Dr. Geddes has been working in co-operation with the National Research Council on the durum wheat problem. Experimental equipment which he has been using will be moved to the research laboratory of the Board of Grain Commissioners and further studies in the milling of semolina and the manufacture of macaroni and spaghetti will be conducted.

NEWS ITEMS

W. B. Gornall, (N.S.A.C. '09) recently appointed Fruit Commissioner to Great Britain, has arrived in England. His business address is Walter House, Bedford St., Strand, W. C. 2, London, England.

John Walker (Alberta '24) is taking post graduate work in horticulture at the University of Minnesota, St. Paul, where his address is 1393 Cleveland Avenue, St. Paul.

B. J. Sallans (Manitoba '21), Assistant Plant Pathologist, Dominion Laboratory of Plant Pathology, Saskatoon, was married on Oct. 6th to Miss Margaret Lockhart of Vancouver.

F. T. Shutt, (Toronto, D.Sc.) Dominion Chemist and Assistant Director of the Dominion Experimental Farm System, has recently retired. Dr. Shutt's divisional staff presented him with a very fine camera and the Central Experimental Farm staff presented him with a grandfather clock. An afternoon reception was held at the Director's home and Dr. Shutt planted an oak tree on the grounds of the Central Farm.

W. A. F. Hagborg (Manitoba '29), is now located at the Dominion Rust Research Laboratory, Winnipeg, in the capacity of Plant Disease Investigator.

A. W. Peterson (McGill '21), Dominion Live Stock Branch, Ottawa, who was listed in the September issue of *Scientific Agriculture* as Assistant Chief in charge of Cattle and Swine, should have been listed as in charge of Swine work.

E. G. Bayfield (Alberta '23), Agricultural Experiment Station, Wooster, Ohio, has recently been made a Fellow of the American Association for the Advancement of Science.

C. A. Lamb (British Columbia '21), who is taking post-graduate work in plant physiology at Cornell, is located at 319 Dryden Road, Ithaca, N.Y.

H. M. Scollie (Toronto '28), formerly of the Chemistry Department, Ontario Agricultural College, Guelph, is now located at Apartment 11, 621 Spadina Avenue, Toronto.

W. E. Walker, (Saskatchewan '17) has changed his address to 117 Eighth St., Saskatoon, Sask.

Donald Cameron (Alberta '30), who has recently returned to Edmonton after enjoying a three months travelling scholarship in Scandinavian countries, is now in the hospital at Edmonton with appendicitis.

G. B. Rothwell (Toronto '05), Dominion Live Stock Commissioner, has rceently returned from a trip to the Old Country where he has been studying the live stock marketing situation.

Wm. Allen (Saskatchewan '22), Professor of Farm Management, University of Saskatchewan, has been appointed a royal commission of one man to conduct a general inquiry into milk prices in Saskatchewan. George Curtis, Regina, will be Secretary to Dr. Allen.

A. T. Charron (Ottawa '92), Assistant Deputy Minister of Agriculture, was married on the eighteenth of September to Alphonsine Mercier of Montreal.